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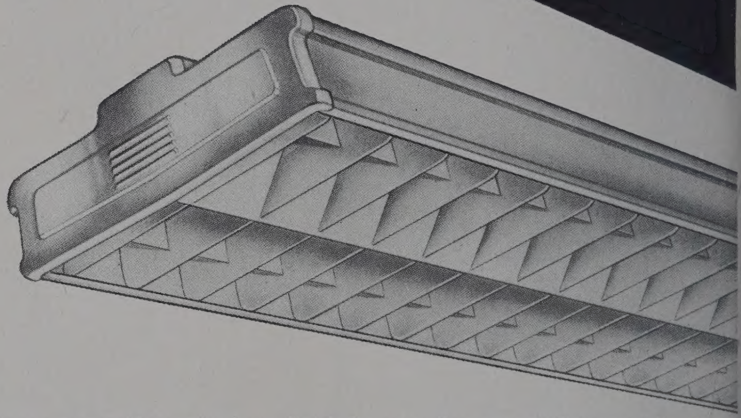

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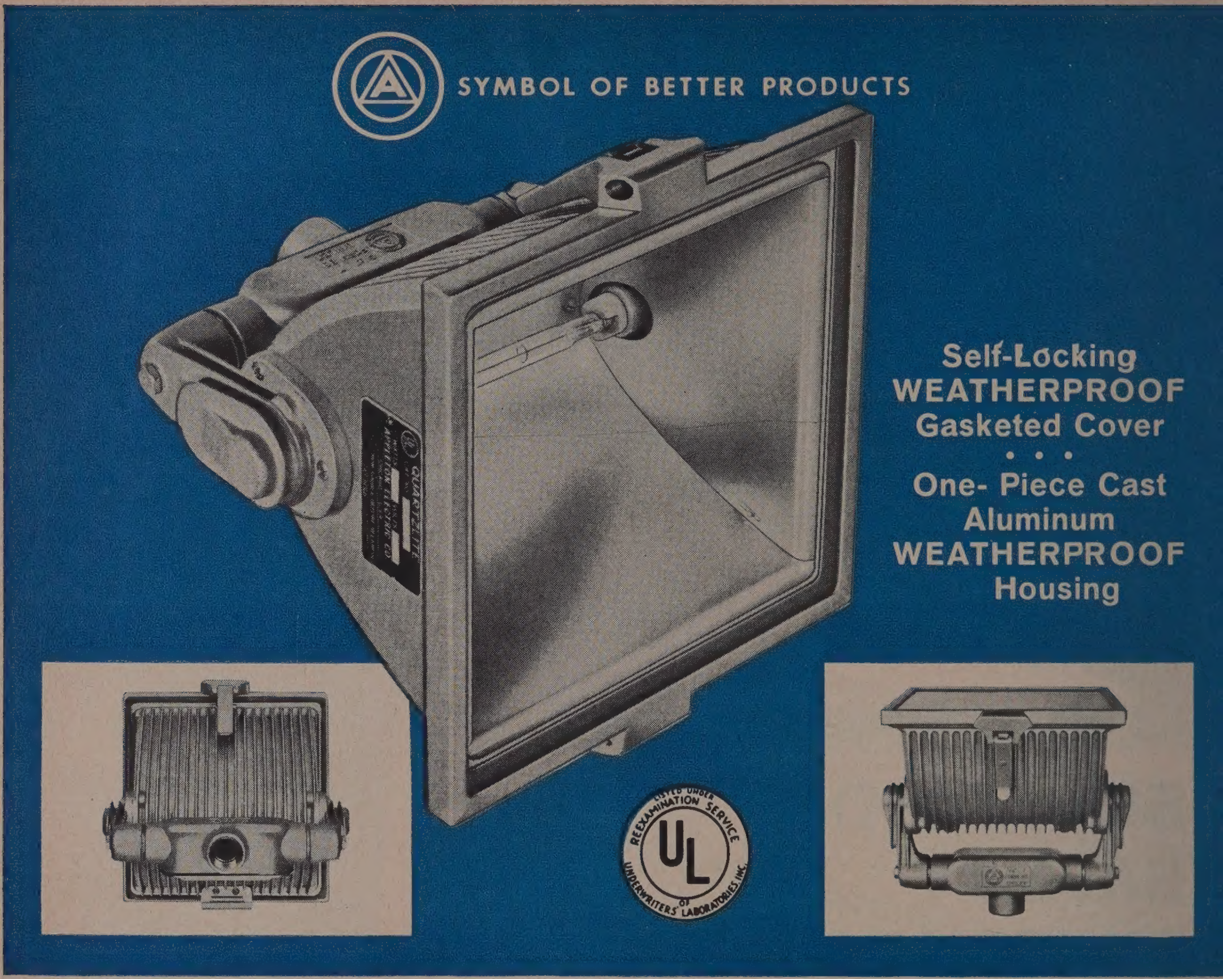
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Electrical Systems for the Seattle Fair 85

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Color-corrected mercury lamps in recessed luminaires were used to relight the Collector's Suite of U. S. Custom House, New York City.

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Control Console Operates Field Concrete Plant 106

An electrically operated, console-controlled concrete plant at Chicago's O'Hare Field was wired by Hyre Electric Co.

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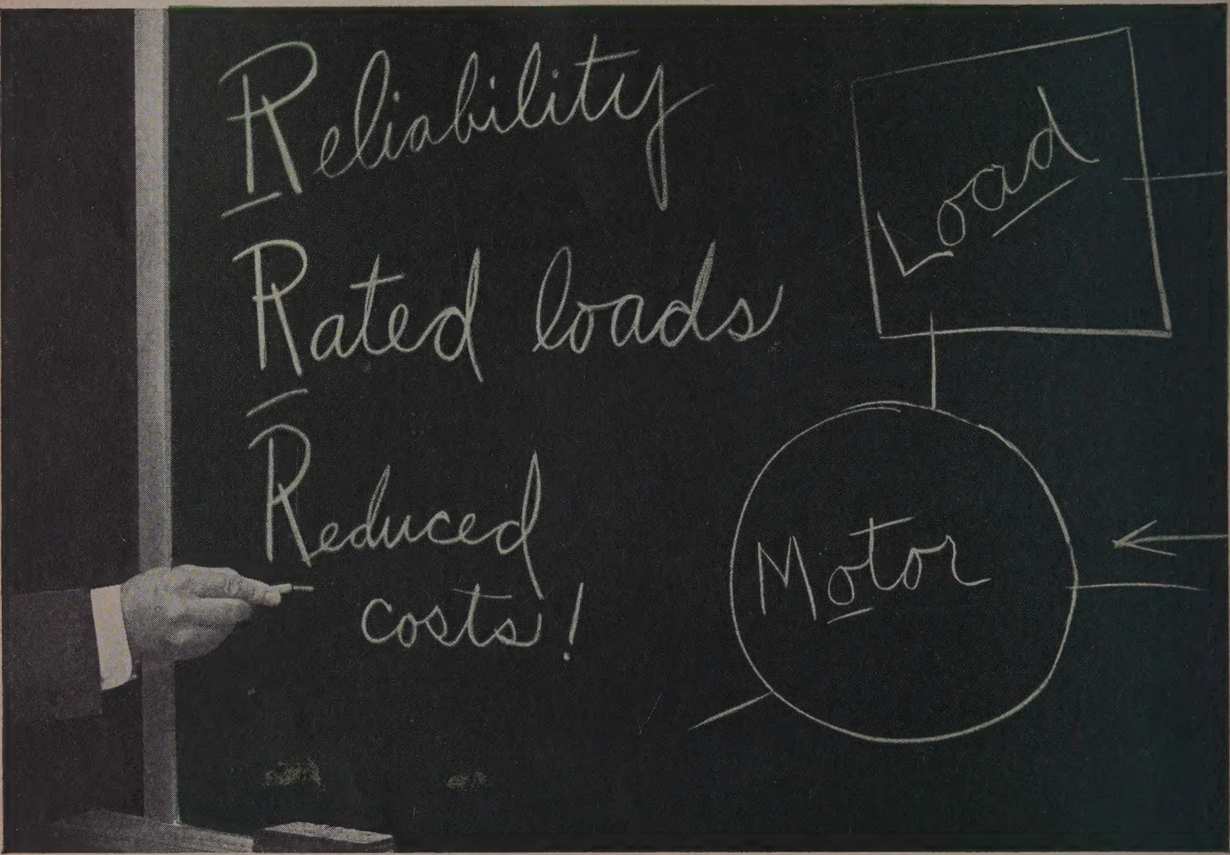

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

JUNE • 1962 *continued*

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Sidelights

CENTURY 21

Of Seattle's world's fair attractions, best known are the "Space Needle," with its slowly revolving restaurant high above the fair grounds, and the "Monorail," a novel transportation system shuttling to down-town Seattle. Both are featured in our cover illustration. But the meat of our report, page 85, is directed to the extensive electrical systems which power the vast complex of buildings and facilities. Much of the work is planned and installed for permanent operation as many major buildings and facilities will be retained and incorporated in a modern new civic center.

MAXIMUM RELIABILITY

It is hard to imagine a more exacting challenge to electrical design and installation than that faced by the consulting electrical engineers and the electrical contractors in providing the electrical supply for the Texas Institute for Rehabilitation and Research in Houston, Texas. Here continuity of electric power is literally a matter of life or death to many patients totally dependent upon "iron lungs" and other mechanical aids to respiration. Many unusual features of the electrical system are described by Associate Editor J. F. McPartland in his report on the project, "Vital Continuity of Power" beginning on page 99.

TOOLS & METHODS

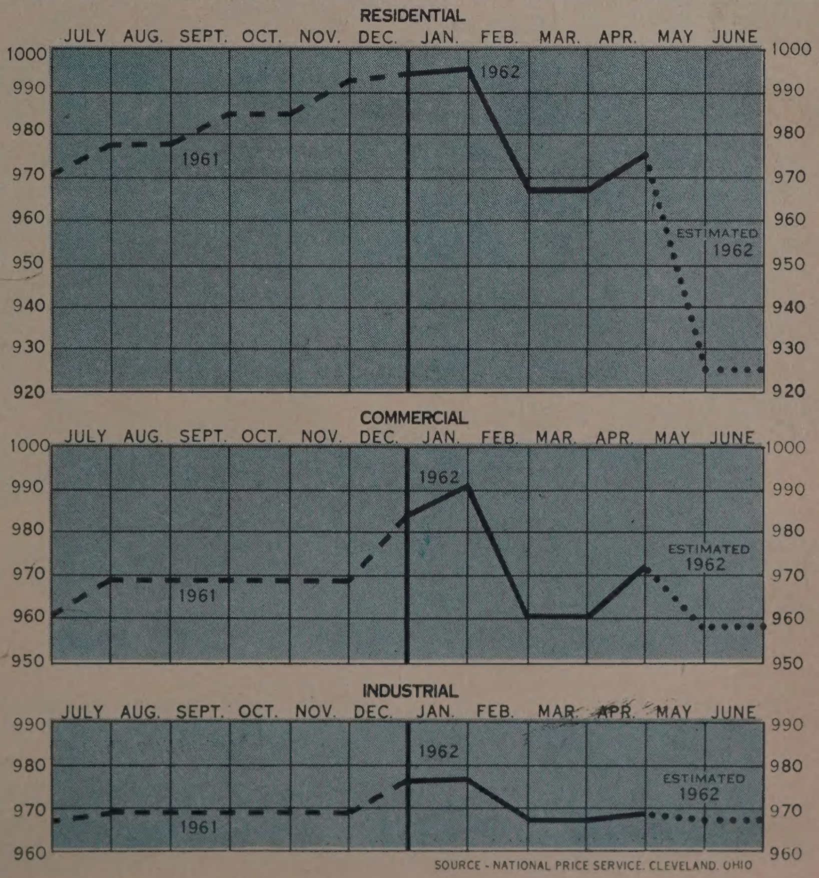
Coming in the next issue is a special editorial report devoted to up-to-date electrical construction, installation and maintenance tools and time saving job methods. The project has been prepared during the past several months by Associate Editor August Eckel and will present an expert summary of current practice on a subject of increasing importance to the industry.

ELECTRICAL MATERIALS COST INDEX

CHANGES IN THE COST OF ELECTRICAL MATERIALS FOR EACH OF THREE TYPICAL JOBS ARE SHOWN ON THESE THREE CHARTS.

THE BASE (1000) REPRESENTS THE AVERAGE COST CF THE MATERIALS FOR THE YEAR 1960

THE MONTHLY INDEX POINTS SHOW THE VARIATIONS IN COST ON THE FIRST OF EACH MONTH.



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Washington Report

JUNE • 1962

Government spokesmen strive to restore the confidence of businessmen in the business outlook, as an attitude of apprehension and uncertainty continues to grow in the wake of President Kennedy's strong-arm tactics in squelching the steel industry's attempt to raise prices in April. In mid-May Chairman Heller of the President's Council of Economic Advisers reported "the economy has shifted into higher gear" and predicted "new profit gains and larger capital investments" by business. Other officials speaking out on behalf of the Administration included Treasury Secretary Dillon, Commerce Secretary Hodges, and Labor Secretary Goldberg—all citing the slight improvements registered in April. These were: high auto sales, increased retail sales, high production, record personal income, reduced unemployment, high employment, optimistic outlook for higher capital spending, and relatively stable prices.

Top business leaders, on the other hand, at the annual meeting of the National Industrial Conference Board, expressed only moderate optimism on the business and economic outlook for the next several months, and voiced concern over the pressure on profit.

Building construction dollar volume is not keeping pace with the annual rate forecast last December by Commerce Department for 1962. That forecast was for $60¼-billion this year. This year's best so far was January's $59-billion annual rate, and the April volume was down to a $57½-billion annual rate. Private expenditures for new construction in April were $3,288 million, and public spending totaled $1,243 million. The April total of $4,531 million was 3.6% ahead of the year-earlier rate, but that can be accounted for mostly by a 3.4% increase in construction costs over this period.

Home construction activity in April hit its fastest pace since mid-1959, with a seasonally-adjusted annual rate of 1,542,000 unit starts. This was 8% higher than in March. It provided new optimism that the Commerce Department's forecast of 1.4 million private units in 1962 would be realized. Last year's level was 1.3 million units.

Industry will increase capital spending by 11% this year, compared with 1961, according to the annual McGraw-Hill spring survey. This will be a record $38 billion for new plant and equipment, if industry's plans are fulfilled. A similar survey by Commerce Dept.-Securities Exchange Commission in January, indicated an 8% gain. Last year's total was $34.4 billion, and the previous record of $37 billion was set in 1957. Historically, capital spending averages about 7¾% of gross national product, in boom periods, but this year's projected $38-billion, if realized, will be only about 6¾% of GNP.

Existing buildings in the nation could shelter 50 million persons from radioactive fallout, in case of a nuclear attack, according to civil defense planners in the Department of Defense. Pentagon plans for the rest of this year call for making these community shelters and stocking them with food, water, medical and other equipment.

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A MESSAGE TO AMERICAN INDUSTRY • ONE OF A SERIES

Modernizing U.S. Industry

The Tremendous Job Ahead and a Key Requirement for Success

Over the past four years American industry has made remarkable progress in modernizing its plant and equipment. But an enormous job of modernization remains to be done in order to provide the efficient productive facilities that are crucial to economic growth and prosperity in the USA. To have a reasonably good chance of doing the job, industry must have relief from the profits squeeze in which it is now caught.

These facts about modernization come from the *15th Annual McGraw-Hill Survey of Business' Plans for New Plants and Equipment,* conducted by our Department of Economics.

How Modern Is American Industry?

Since 1957, when McGraw-Hill last checked the age of American industry's producing facilities, the obsolete and antiquated share has been substantially reduced. In 1957 about 50% of our industrial capacity was over 12 years old — for most of it that meant thoroughly antiquated. Now the latest McGraw-Hill survey has found that the proportion of comparably ancient equipment has been reduced to 40%. This is real progress, often made under difficult circumstances.

But the facts provided by the survey also underline the tremendous modernization job that remains to be done. This is indicated by the table in the next column, which shows not only that 40% of our plant and equipment dates back to before 1951, but that 24% goes back to World War II or even before that. This segment deserves a place in Washington's Smithsonian Institution alongside Lindbergh's *Spirit of St. Louis.*

The 40% of industrial facilities dating back more than a decade is the average of U.S. industry as a whole. Some industries are in far better, or worse, shape than others.

AGE OF U.S. PLANT AND EQUIPMENT, DECEMBER 1961

INDUSTRY	Percent Installed Before 1957	Before 1951	Before 1946
Iron & Steel	66%	37%	27%
Nonferrous Metals	65	34	21
Machinery	68	41	24
Electrical Machinery	55	30	18
Autos, Trucks & Parts	71	21	8
Aircraft	56	28	17
Other Trans. Equipment	74	56	43
Fabricated Metals & Instruments	67	38	25
Chemicals	67	36	21
Paper & Pulp	69	39	23
Rubber	68	40	23
Petroleum & Coal Products	62	32	20
Textiles	73	49	32
ALL MANUFACTURING	67	40	24
Mining	71	38	24
Railroads	71	58	39
Electric Utilities	65	36	23
ALL INDUSTRY*	67	40	24

*Does not include commercial business or gas utilities.

Source: *15th Annual Survey of Business' Plans for New Plants and Equipment, McGraw-Hill Department of Economics.*

As the table shows, the auto industry has only 21% of its facilities dating back to before the Korean War. The aircraft industry is not too far behind with 28% of its plant and equipment in that age category. The railroads, on the other hand, are burdened with huge amounts of antiquated facilities. So, too, are the textile, furniture and shipbuilding industries.

But the 40% of overage equipment is a good gauge of the magnitude of the modernization to be done if we, as a nation, are to meet the many challenges that confront us.

The Challenges

There is the challenge of overseas competition. Producers in the European Common Market countries and in Japan have put a large part of their industrial capacity into first-class shape over the past decade, and, on balance, their facilities are considerably more up-to-date than ours. This enables them to give us tougher competition in the world's markets than ever before.

There is the challenge of the scientific explosion. In the more relaxed days of just a few decades ago, the need to modernize would not have been so urgent. New ideas germinated more slowly, and the pressure to put them to industrial use was less intense. But how things have changed! Estimates are that 90% of all the scientists the world has ever known are alive today, and in the U.S. alone we spent more on research and development during the past decade than we had spent since the settlement of Jamestown in 1607. This means that new ideas for new products and new cost-cutting ways of making them are streaming from the world's laboratories at breathtaking speed. It's up to U.S. producers to put these new developments to work with new producing equipment.

And there is the Communist challenge. Premier Khrushchev threatens to "plow us under," to outproduce us in a contest of industrial strength. A crucial element in this all-out struggle is the relative efficiency of the industrial equipment of the contestants.

Some Help

Our business leaders have clearly recognized the critical need of modernizing their producing facilities and have been working hard to meet it. This is attested by the fact that McGraw-Hill surveys indicate that manufacturers alone spent nearly $34 billion, or about two-thirds of their total investment, on modernization in the years 1958-61. And manufacturers now report, through the latest survey, that they plan to raise the modernization share to nearly 70% during the years 1962-65, the highest figure planned in the last decade.

Increased allowances to offset the depreciation of its plant and equipment have helped American industry greatly in getting ahead with the modernization job. Annual depreciation allowances for corporations have increased from $13.5 billion in 1954 to $24.4 billion in 1961. Legislation passed in 1954 permitting some acceleration in depreciation charges has contributed to this increase. Some further liberalization of depreciation allowances is also promised soon. This, too, will give an important lift to the modernization job.

Getting The Job Done

But to give a decisive boost to the tremendous task of putting America's industrial plant and equipment in tip-top condition, there is another key requirement. It is to relax the profits squeeze which now dulls both the incentive to modernize and cuts the capacity to do so. This incentive and capacity, as explained in the previous editorial in this series on *The Profits Squeeze*, is heavily dependent on business profits.

There are various ways of relaxing the profits squeeze. One, at which industry is hard at work, is to cut costs. Another is to raise prices. (President Kennedy battered down an attempt on the part of the steel industry to cope with the problem this way.) **A third, and in the present circumstances by far the best way to ease the squeeze on profits, is to cut the corporate income tax. Except for very small companies, this tax takes 52¢ of every dollar of business profit. A substantial cut in the corporate income tax is the surest way of insuring success in the enormous job of industrial modernization ahead, as well as giving a general infusion of new vitality to the American economy.**

This message was prepared by my staff associates as part of our company-wide effort to report on major new developments in American business and industry. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or part of the text.

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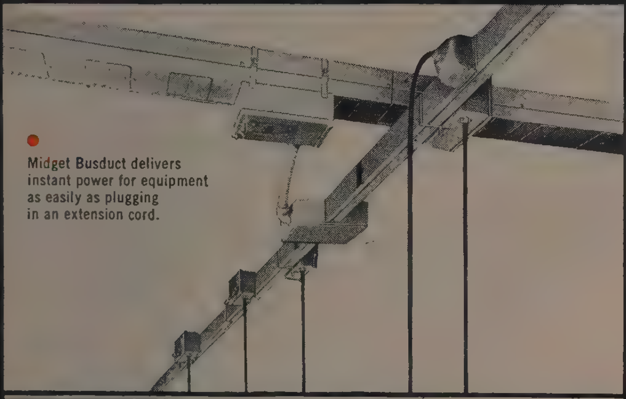

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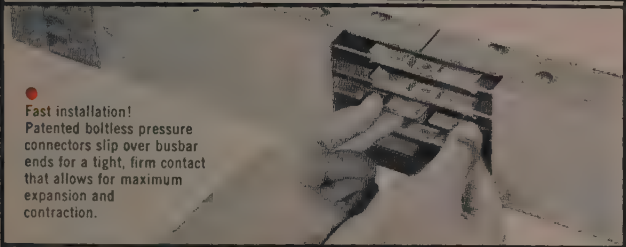

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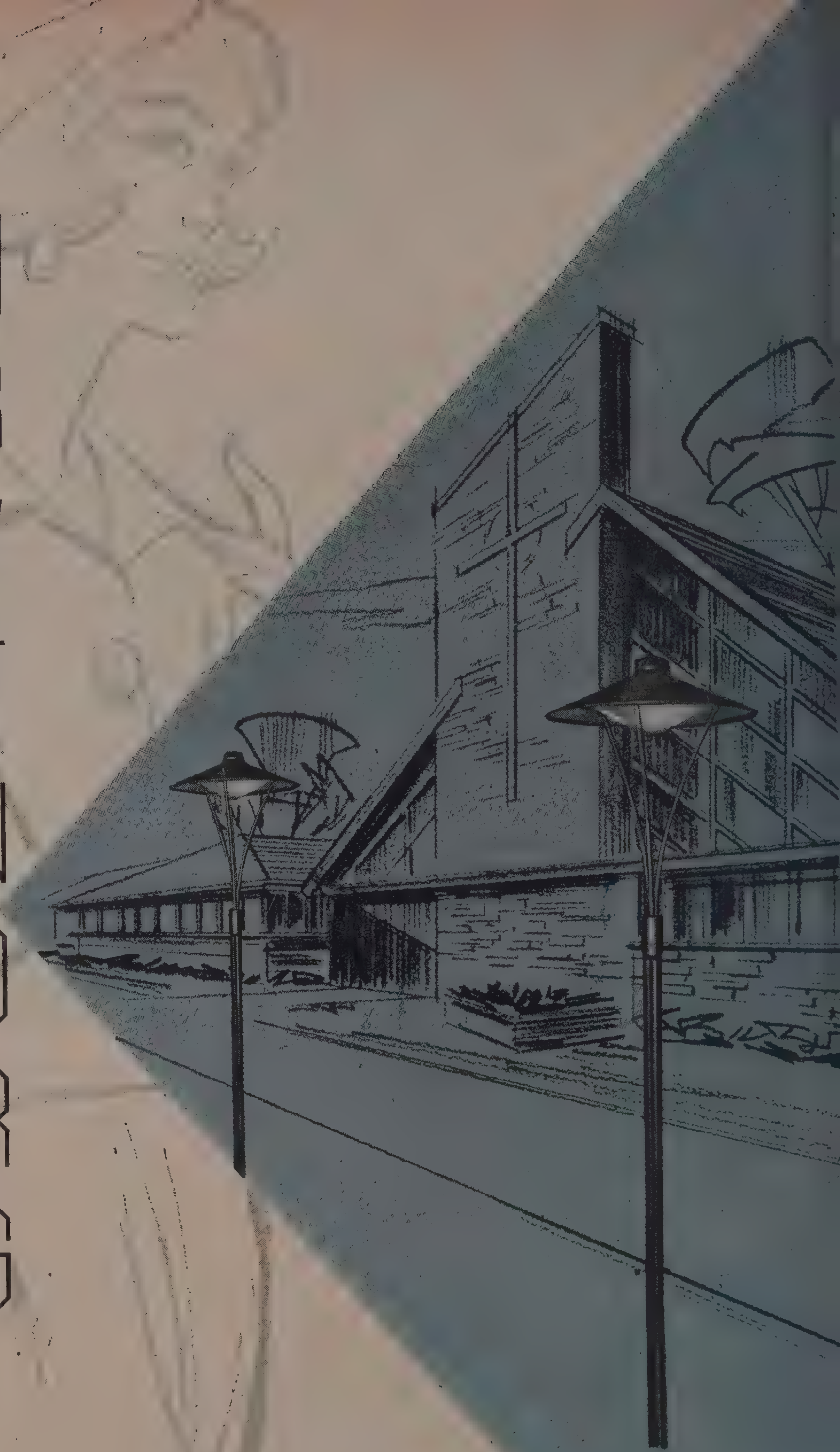
KEEP PACE ELECTRICALLY

L-M DESIGNS THE NEW CONCEPT IN STYLED OUTDOOR LIGHTING



THE CONTEMPORARY STYLE A LAWN-GLO™ here lights the grounds of a modern church building. Weatherproof all-aluminum construction, ease of maintenance, and choice of decorator colors are desirable features of the unit. Available with or without photoelectric control. Accommodates 150 watt lamp.

TRADITIONAL LAWN-GLO is an authenti reproduction of an Early American carriag lantern. Prismatic, shatterproof panels provide scientific light control, direct light downward and prevent glare. Accommodates lamp up to 150 watts. Available in black and gold or white and gold.

L-M's LAWN-GLO units comprise a complete, hig style line for a wide variety of residential and commercial applications.

Made by the leader in styled outdoor lighting LAWN-GLO units are built to highest qualit standards. Efficient manufacture and quantity production assure relatively low cost for these products

LAWN-GLO units are styled by Jean Reinecke noted industrial designer. They meet the requirements of smart daytime appearance and soft, low-level lighting at night. They are designed t complement the daytime beauty of homes, estates parks, and grounds of hotels and motels—and a night, give adequate but gracious lighting with a atmosphere of hospitality and charm.

Line Material offers a complete line of lightin luminaires and equipment—all styled to complemen your lighting installation. Everything—fixtures, poles controls and hardware—is available from L-M.

Authorized L-M Distributors, or L-M Field Engineers will gladly provide complete technical data, and lighting application engineering. Call the distributor, the nearest L-M office or write Line Material Industries Milwaukee 1, Wisconsin.

AT AN ELEGANT FLORIDA MOTEL this contemporary Style C LAWN-GLO provides soft, gracious illumination for the entrance walk. Also available with bracket for wall mounting.

LINE MATERIAL®
Industries
McGRAW-EDISON COMPANY
McGRAW EDISON

Outdoor Lighting

DISTRIBUTION TRANSFORMERS · RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS · POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE AND CONDUIT

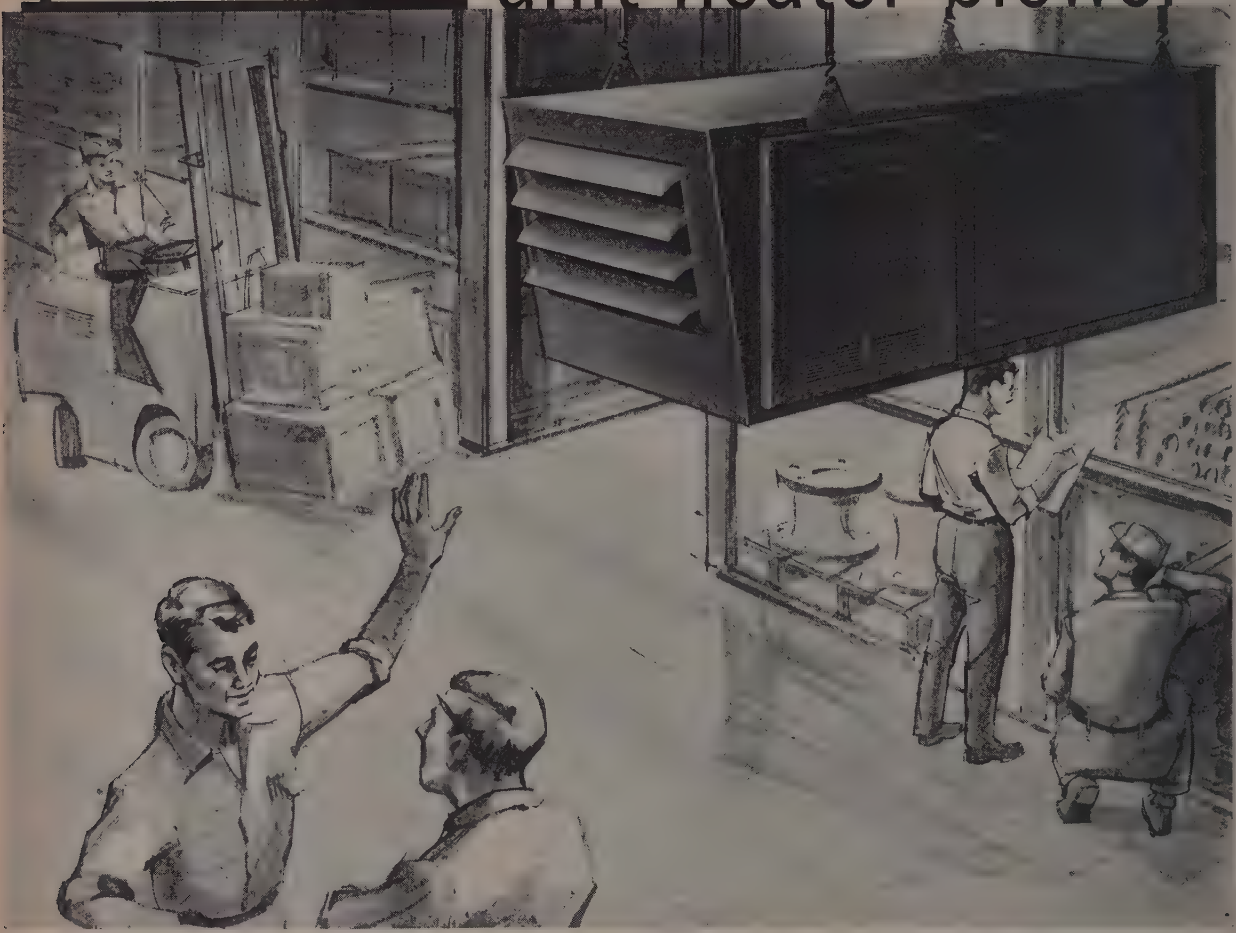
MAIL THIS COUPON

LINE MATERIAL Industries, Milwaukee 1, Wisconsin

Please send me bulletin on the LAWN-GLO line and name nearest Authorized L-M Distributor. ECM-6

Name____________________
Title____________________
Company____________________
Address____________________
City____________________State__________

Electromode unit heater blower



suspends commercial and industrial heating problems!

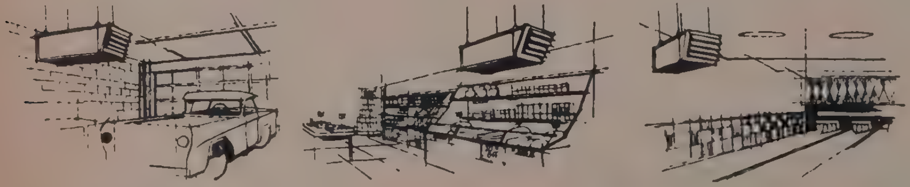
SAFE . . . first and foremost advantage with every ELECTROMODE product! The Exclusive Safety-Grid . . . only Electromode has it. The electric heating element is embedded and completely sealed inside the finned aluminum casting. There are no open wires or glowing elements.

VERSATILE . . . use one or a number for complete or supplementary heating, in small buildings or large industrial plants.

CLEAN . . . flameless heat is smokeless and fumeless heat. Healthier working conditions; and equipment stays clean longer.

PRACTICAL . . . ceiling suspension frees valuable floor space, also cuts initial construction costs.

QUIET . . . heavy duty, mat-faced fiberglass insulation reduces operating sounds.



KEEP PACE ELECTRICALLY

Electromode

Division Commercial Controls Corporation
ECM-62 ROCHESTER 3, NEW YORK

COMPLETE LINE: Features more than 400 types, models and capacities of heaters and heating systems, all with **exclusive** Safety Grid. The solution to your heating problem is in the Electromode catalog.

Anti-perspirant

(anchors metal to concrete with no sweat)

If you're not using a Shure-Set® tool, you're working too hard. Shure-Set lets you anchor wood or light gauge metal to concrete with 5 or less hammer taps. Just slip a Shure-Set fastener in one end. Strike the other with a hammer. Rap-rap-rap-rap-rap. It's done. A built-in piston concentrates the energy of the hammer blow, drives the fastener through the work. No drilling. No expansion devices. No powder charges. And no sweat. Shure-Set tools and fasteners are available from your local Ramset or Shure-Set dealer. He's listed in the Yellow Pages, under "Tools."

Ramset® WINCHESTER-WESTERN DIVISION **Olin**
285-F Winchester Ave., New Haven 4, Conn.

CBM CERTIFIED by ETL

SPECIFY LIGHTING WITH CONFIDENCE

General Electric *Bonus Line** Ballasts won't leak or smoke at end of life

General Electric Bonus Line Ballasts are designed to protect against smoking, leaking, or any of the unpleasant conditions which sometimes occur when a ballast fails.

An integrated thermal protection system de-energizes the ballast permanently when extreme temperatures—sometimes characteristic of ballast end of life—are detected. Voltage or current surges will not affect the system. The ballast is de-energized only when failure is *already in progress.*

The protective system consists of two non-resetting thermal protectors, one located near the coils, the other inside the capacitor. No need for external, individual ballast fusing.

Specify General Electric's Bonus Line Ballasts. They give many years of reliable service before end of life. Then they bow out gracefully.

For a technical paper on ballast thermal protection, contact your General Electric Ballast Sales Engineer. Or write to Section 403-04, General Electric Company, Danville, Illinois.

* Trademark, General Electric Company.

NEW...Another Added Value From *Bonus Line** Ballasts!

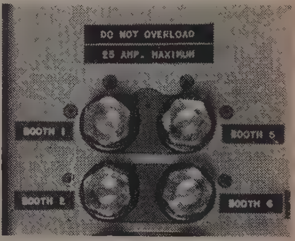
Certain fluorescent fixtures equipped with General Electric Bonus Line Ballasts have recently been listed by Underwriters' Laboratory, Inc., as complying with National Electrical Code requirements for direct surface-mounting on combustible, low-density, cellulose fiberboard ceilings. Contact your G-E Ballast Sales Engineer for details.

Progress Is Our Most Important Product

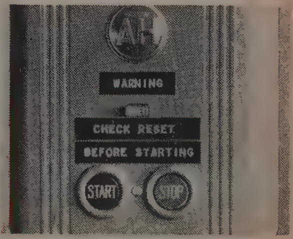
GENERAL ELECTRIC

PERSONALIZING

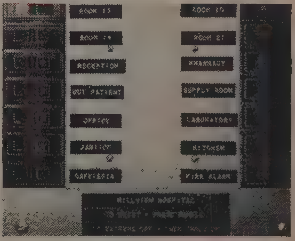
HARD HATS



FUSE BOXES



CONTROL BOXES



CIRCUIT BREAKERS

RAISED LETTER LABELS
MADE ON THE SPOT

If it can be mistaken, mislaid, misfiled, misused, misanything—label it with Dymo. See for yourself how easily you can make handsome, raised-letter labels for 1001 applications. Embossed labels take seconds to make, cost pennies, stick permanently to almost any surface. Vinyl tape in 10 colors, five striped tapes, six metal tapes. Five Dymo Tapewriter models, from $24.95. Send the coupon for a free booklet "1001 Applications" for manufacturing, administrative, inventory, personalizing, professional, electrical, municipal, schools, electronics, and many more — along with a name badge personalized with your name.

Embossed letters provide maximum **permanent** legibility, quality appearance.

DYMO®
INDUSTRIES, INC.

Prices slightly higher in Canada

WRITE FOR FREE BOOKLET "1001 APPLICATIONS" AND YOUR SAMPLE NAME BADGE

Dymo Industries, Inc., Department ECM-6
P.O. Box 1030, Berkeley 1, California

Please send me free booklet "1001 Applications" and my name badge as follows.

Name ______________________________ (PLEASE PRINT)
Title: ______________ Firm ______________
Product or Service ______________ Tel. ______________
Address ______________________________
City ______________ Zone ______________ State ______________

Stellite coated exhaust valves and valve se
One of the toughest alloys known. Gives
up to 300% longer valve life than uncoa
valves. It's the important details like this
make Onan more economical in the long

Here's how we could cut Onan electric plant prices 18%

. . . and here's why it wouldn't pay off for you

Onan's 1500-watt portable Electric Plant—the 105AK-1P—lists at $375.00.

We could build and sell a 1500-watter for $309.00—17½% cheaper in this particular unit, a list price "savings" of $66.00 for you.

This cheap plant wouldn't have Stellite valves. The crankshaft wouldn't be as strong. The bearings wouldn't be as big. It would not have an oil pump, but this would cut the cost $14. This cheap plant would have mediocre shielding, a 40¢ "muffler," a "bailing wire and tape" carrying frame. And there'd be no money for running-in and testing, no money for Performance Certification.

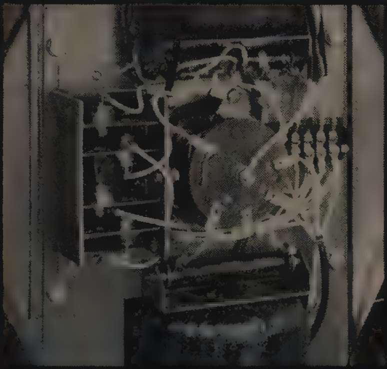
So we don't think a price cut makes sense, either for you or for us. *Because you do get what you pay for.* And we believe that when you buy an Electric Plant, you lay the money out only because you need a dependable source of on-site power. The unit that won't deliver what it promises, that won't stand up under hard use, isn't really a bargain at any price.

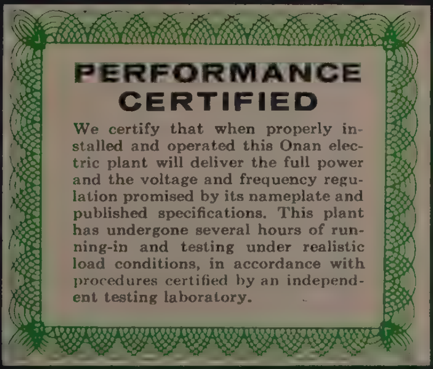
Your Onan distributor can cite other examples. So next time you're tempted by price bait, talk it over with your Onan man first. He's listed in the Yellow Pages. Or write us direct.

Onan

ONAN Division, Studebaker-Packard Corp. • 2570 University Ave. S.E., Minneapolis, Minn.

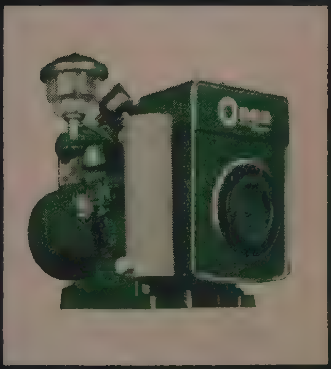
Onan's exclusive Magneciter generator is static excited to eliminate rotating exciter and mechanical regulator. Moving parts are eliminated in *both* exciter and regulator. Voltage recovery is five times faster than brushless type.





PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.



TOOLS
THAT MAKE MORE
MONEY!

ACTUAL SIZE

THE NEW POCKET SIZE TOOLS!

The rugged, light weight No. 607 Indentor for ½" fittings is shown here full size.

B-M { THE ORIGINAL INDENTOR TOOLS THE ORIGINAL INDENTOR FITTINGS

These are the tools and fittings that have revolutionized setting up thin wall conduit. B-M, the Original Indentor Tools have been working efficiently for over 25 years—doing more work easier and lowering installation costs. Now, B-M Indentors have been re-engineered and redesigned to reduce size and weight to increase efficiency and ease of operation. These B-M Indentors with the new patented compound leverage are now only plier size. They are lighter to carry, easier to use and the leverage does the work.

B-M, the Original Indentor Fittings go with B-M Indentor Tools like ham and eggs. Contractors who demand the best always call for the Original B-M Fittings for the soundest, most permanent installations possible. The fittings are concrete tight and vibration resistant. All steel, heavy gauge fittings are heavily bright zinc plated and have been salt spray and acid drip tested for corrosion resistance. Additional features are extra heavy bonding locknuts. Smoothly rounded edges or bushed throat type connectors make fishing easier and prevent damage to insulation.

For fast, safe installation plus complete protection always specify the Original B-M Indentor Fittings and the Original B-M Indentor Tools.

BM-21B
½" Connector
BM-22B
¾" Connector
BM-23B
1" Connector

BM-41
½" Coupling
BM-42
¾" Coupling
BM-43
1" Coupling

BM-51
½" Offset Connector
BM-52
¾" Offset Connector

BM PLIER SIZE INDENTORS
BM—No. 609 1" BM—No. 608 ¾"
BM—No. 607 ½"

BRIEGEL METHOD TOOL CO.

GALVA, ILLINOIS

All B-M indentor type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

USED THE MOST FROM COAST TO COAST

ADVANCE In-warranty Labor Insurance compensates for normal ballast replacement labor cost

ADVANCE IN-WARRANTY
ILI
ADVANCE TRANSFORMER CO.
LABOR INSURANCE

what is ILI?

The ADVANCE TRANSFORMER CO. ILI (In-warranty Labor Insurance) Program is designed to reimburse the Electrical Contractor for normal labor costs incurred in replacing ADVANCE In-warranty High Power Factor Fluorescent Lamp Ballasts.

ILI permits the Contractor to guarantee both labor and ballasts in fluorescent lighting installations. It gives fast and more efficient service for lighting equipment manufacturers' products if an ADVANCE Ballast becomes inoperative within the two-year warranty period.

Here's how ILI works ....

1 The Electrical Contractor contacts his ADVANCE Representative when he experiences an ADVANCE in-warranty ballast failure. The ADVANCE Representative will qualify the job and issue an (In-warranty Labor Insurance) ILI number.

AUTHORIZED ADVANCE SERVICE-STOCKING DISTRIBUTOR
BALLAST ELECTRICAL SUPPLY COMPANY

2 The Electrical Contractor takes the inoperative ballast together with the (In-warranty Labor Insurance) ILI number to any ADVANCE Service-Stocking Distributor. The Distributor supplies the Contractor with new ADVANCE Ballasts at no charge and gives the Electrical Contractor an ILI form.

3 The Contractor completes and sends the form to ADVANCE TRANSFORMER CO., 2950 N. Western Avenue, Chicago 18, Ill. He receives a non-negotiable check for replacement labor cost which will be redeemable in merchandise at any ADVANCE Service-Stocking Distributor.

WRITE FOR COMPLETE ILI BROCHURE

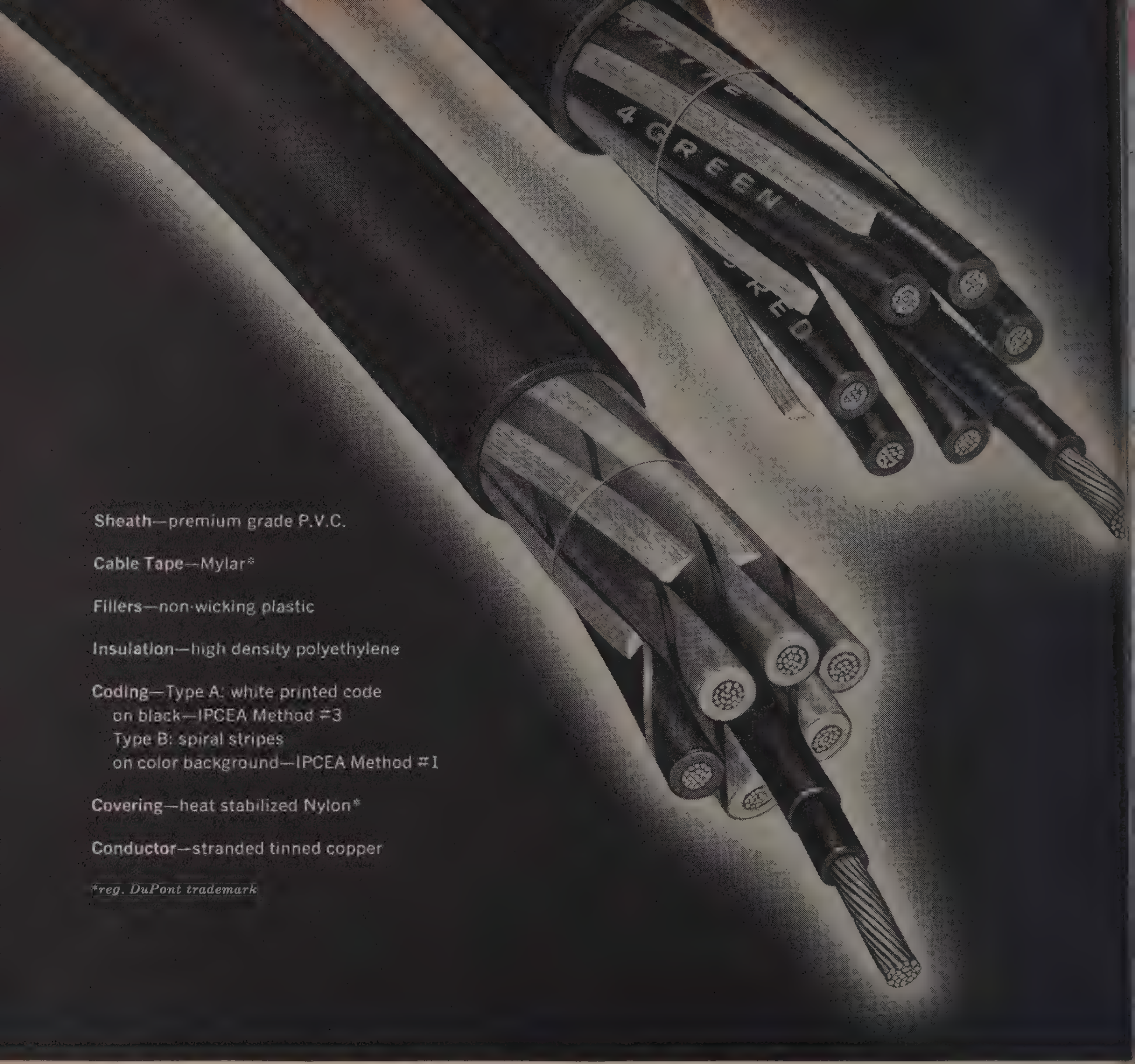
"The Heart of the Lighting Industry"®

ADVANCE® TRANSFORMER CO.

CBM CERTIFIED

WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FLUORESCENT LAMP BALLASTS

2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.



Sheath—premium grade P.V.C.

Cable Tape—Mylar*

Fillers—non-wicking plastic

Insulation—high density polyethylene

Coding—Type A: white printed code
on black—IPCEA Method #3
Type B: spiral stripes
on color background—IPCEA Method #1

Covering—heat stabilized Nylon*

Conductor—stranded tinned copper

**reg. DuPont trademark*

New Rockbestos 90°C Plastic Control Cable Offers maximum circuit reliability

Rockbestos PNR X-90, 600 volt, plastic control cable was designed specifically to provide maximum circuit integrity under extreme environmental conditions...resulting in lower cost per service hour.

Suitable for aerial, conduit or direct burial service at temperatures from −67°F to +195°F, PNR X-90 features a number of other important advantages due to its unique construction. It has excellent resistance to heat distortion, cold flow, environmental stress cracking, temporary overload conditions and exposure to most chemicals and oils.

We invite you to compare the construction features and physical and electrical properties of PNR X-90 with IPCEA requirements listed on the opposite page *or with any competitive plastic cable.* See for yourself how extra quality and extra reliability, are designed into Rockbestos PNR X-90 plastic control cable.

Physical Properties of PNR X-90 Exceed IPCEA Specifications

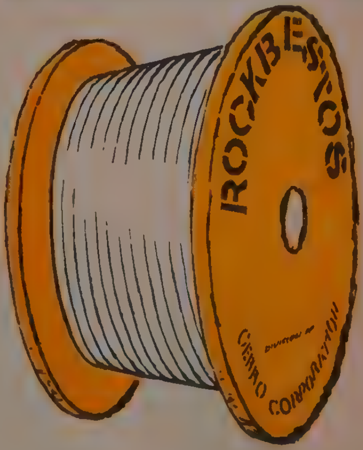
ROCKBESTOS PNR X-90	I.P.C.E.A. S-61-402	ADVANTAGES PNR X-90
Coated conductors	Uncoated	Quicker soldered connections. Cleaner, more positive pressure connections.
High Density PE insulation	Regular PE	Tougher, crack-resistant, better heat and cold resistance.
Nylon insulation covering	Optional	Better abrasion—, heat—, and chemical-resistance.
Non-hygroscopic, non-fibrous fillers	Material not specified	No moisture wicking.
Mylar cable tape	Not required	Rounder cable—easier to handle, cleaner. Tape improves flexibility, augments jacket toughness, and serves as chemical barrier.
Premium PVC jacket, 90% concentricity	General purpose PVC—80%	Tougher, better heat distortion resistance, improved cold resistance, flexibility and resistance to wear.

Electrical Test Results also Prove Superiority of PNR X-90

TESTS	I.P.C.E.A. S-61-402	ROCKBESTOS RSS-3-201	TYPICAL VALUES
POLYETHYLENE INSULATION			
Original:—tensile, psi	1400 min.	2800 min.	3,100
—elongation, %	350 min.	250 min.	300
NYLON COVERED CONDUCTOR			
Dielectric strength: (X-90)			
Heat distortion—10#, 115°C 24 hr.	———	12,000v. min.	22,000v.
Cold flow—50#, RT, 24 hr.	———	20,000v. min.	50,000v.
Tank—6 hr. water #12—600v.	3000v. min.	3,000v. min.	OK
Insulation Resistance K— 6 hr. in water	30,000 min.	50,000 min.	OK
SAE20 oil, 70°C., 4 hr:			
PE tensile, % of original	———	90 min.	93
PE elongation, % of original	———	90 min.	92
Cold blend—55°C., 1 hr.	No cracks	No cracks	OK
SHEATH			
Original: tensile, psi	1500 min.	1900 min.	2,500
elongation, %	100 min.	175 min.	275
SAE20 oil, 70°C., 4 hr:			
tensile, % of original	80 min.	85 min.	96
elongation, % of original	60 min.	85 min.	92
Heat distortion, 121° C 1 hr.:—%	50 max.	30 max.	14

Here's another fact worth remembering... the serviceability of the basic plastic construction of PNR X-90 cable has been proved in two ways: in the millions of feet of regular, small-diameter PNR cable used in hundreds of installations since it was introduced in 1948, and in its adoption by military specification for severe environmental conditions.

On your next critical control circuit installation specify Rockbestos PNR X-90 for extra reliability.



ROCKBESTOS WIRE & CABLE CO.
DIVISION OF **CERRO CORPORATION**
MAIN OFFICE AND FACTORY: Nicoll and Canner Streets, New Haven, Conn.

THIS LITTLE WINDOW

xclusive Li-tronic* control is just one of many trend-setting

ly Federal Pacific electric heat has Li-tronic, the light- nsitive electronic control that lets you "heat your home e way you light it." Li-tronic "sees" through a small ndow in the thermostat face plate. When the lights go on, tronic immediately turns up the heat to the preselected mfort level. When the lights go off, Li-tronic turns down e heat to another preselected level that can be as much 10 degrees lower!

w, for the first time, a heating system automatically goes sleep when the people in the room do. It wakes up when ey do. It maintains room temperatures to a precision ver before attainable in any kind of system!

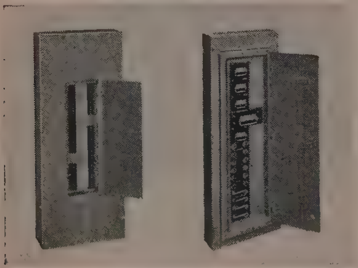
Talk about economy! Li-tronic control saves the homeowner important dollars by eliminating unnecessary heat. The operating efficiencies insure significant savings.

Talk about convenience! Once the homeowner has set both the comfort level and the sleeping level, he need never touch the thermostat again!

Talk about reliability! There are no moving parts in the Li-tronic solid state electronic control...nothing to wear out!

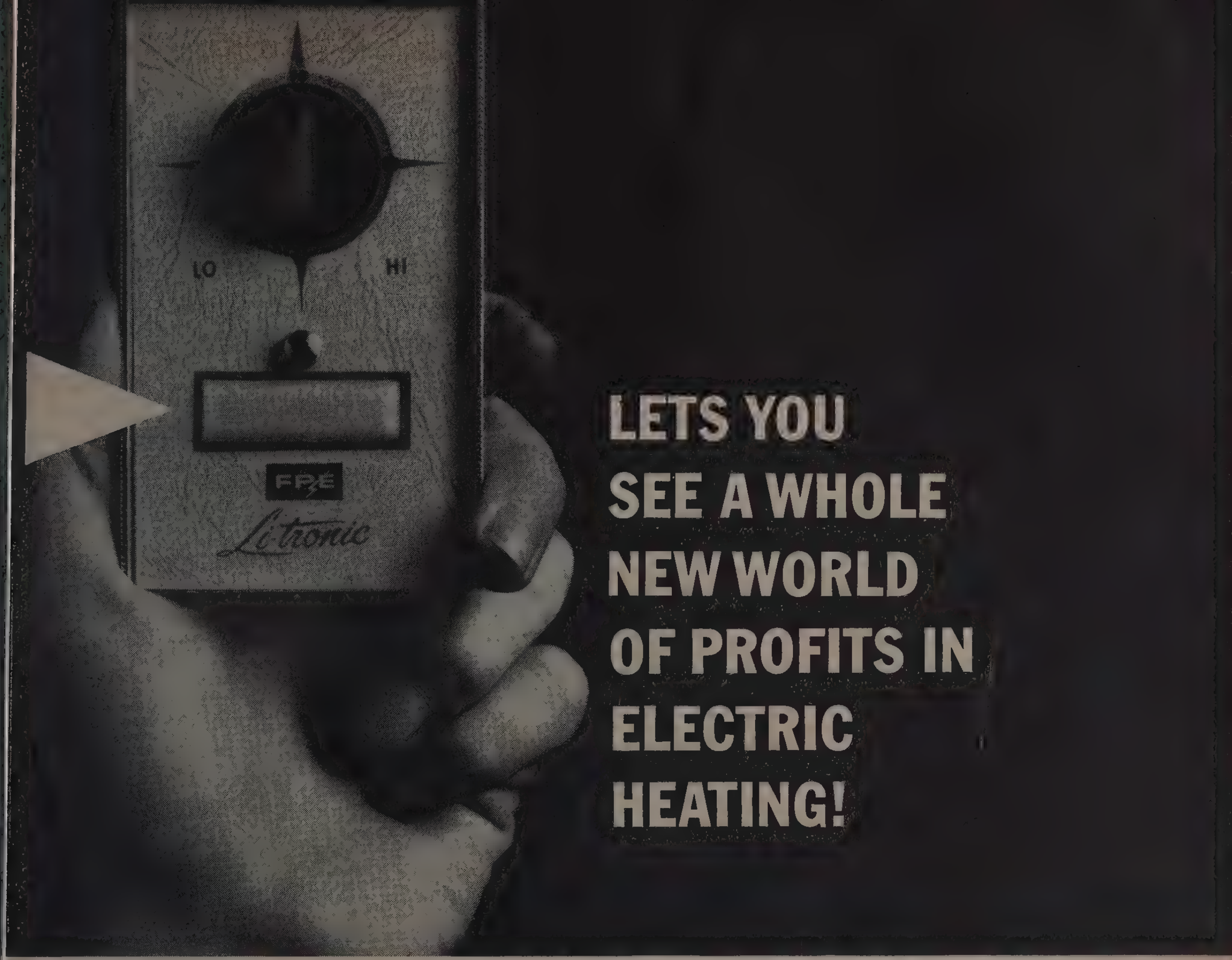
Talk about profits for you! Count on Federal Pacific to give you the kind of electric heat you can sell...the kind of elec-

FPE OFFERS YOU THE INDUSTRY'S ONLY TOTALLY INTEGRATED AND



SERVICE ENTRANCE EQUIPMENT. Stab-lok circuit breaker and SF-Fusible...proved by more than 80 million protected circuits.

EXCLUSIVE CONTROLS. Li-tronic light sensitive wall thermostat. The "Rate-Saver"...and the "Load Miser" eliminate the need to rewire! Also available: base board thermostats, and wall-mounted thermostats with thermometer.


LO
HI
FPE
Li-tronic
LETS YOU SEE A WHOLE NEW WORLD OF PROFITS IN ELECTRIC HEATING!

advances in Federal Pacific's total electric heating system.

ric heat you can install in a breeze (the Li-tronic thermostat nstalls as easily as an ordinary wall switch)...the kind of lectric heat that lets you see a whole new world of profits!

But there's more. The FPE system is a totally new kind of ystem—a totally-integrated, perfectly-matched system—rom Stab-lok circuit breaker or SF-fusible service equipment, to the exclusive controls, to the superbly engineered and Raymond Loewy-styled baseboard units. Now you get hem all from one source. Now you can get them all from ederal Pacific, the acknowledged leader in the control and distribution of electricity, the company that originated modular service entrance circuit protection!

And if that's not enough, consider this: now you can install electric heat throughout the house without changing or increasing service entrance capacity in most cases. Federal Pacific's "Rate-Saver" and "Load Miser" make it possible. Take your choice...with either one, you can sell electric heat to every homeowner who "couldn't afford it" before!

There's a big-leaguer in electric heat at last! This is the opportunity you've always wanted. Now it's your move. Call your FPE man and get the whole story. It may prove to be the smartest move you've made in years.

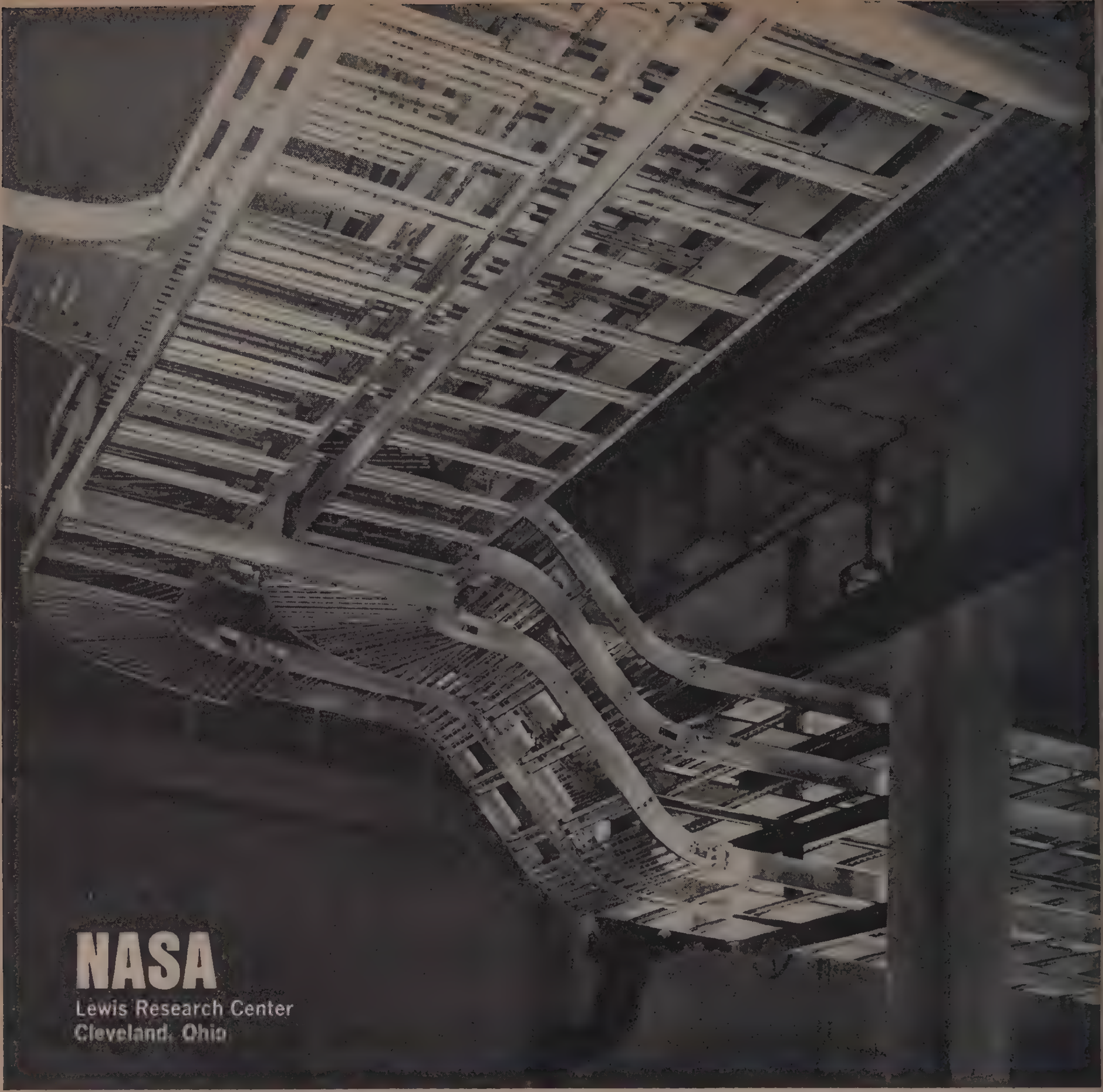
FEDERAL PACIFIC ELECTRIC COMPANY, 50 PARIS STREET, NEWARK 1, N. J.

PERFECTLY MATCHED ELECTRIC HEATING SYSTEM.

BASEBOARD UNITS. Installation is quick because raceways are prewired...units are packaged in the order in which they are used. Modular lengths: 32", 64" and 96". Reflector fins are shaped to provide 24 individual air flow channels per foot of heating element...rapid air movement over and through the channels quickly transfers heat.

FPE FEDERAL PACIFIC

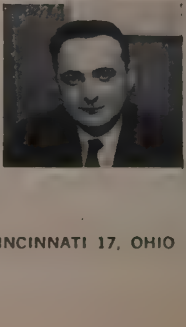
*Li-tronic is the trademark of the Federal Pacific Electric Company.



NEW VENTRAY... A-OK

Low Material Cost—thru engineering know-how and modern advanced manufacturing techniques.
Low Installation Cost—made possible thru lightweight steel design and rapid QIKLOK™ splice.
Interchangeable—used with VENTRIB™ cable basket for maximum system flexibility.

Lake Erie Electric, contractor on the NASA job, is completely satisfied with the new low-cost, ladder type VENTRAY™. The VENTRAY and VENTRIB in-stock parts made difficult changes of direction and elevation (shown above) and the entire installation a simple assembly operation.



Mr. Wm. M. Leblang, Vice President of Lake Erie Electric, Inc., Cleveland, Ohio—says: "We were pleased with ease of installation due to your lightweight steel design. Your competitive price, accurate take-off, installation drawings and prompt order service all contributed to an efficient labor saving installation."

See your local representative or electrical distributor or write Husky Products, Inc.

HUSKY DIVISION OF **BURNDY** 5300 VINE ST., CINCINNATI 17, OHIO

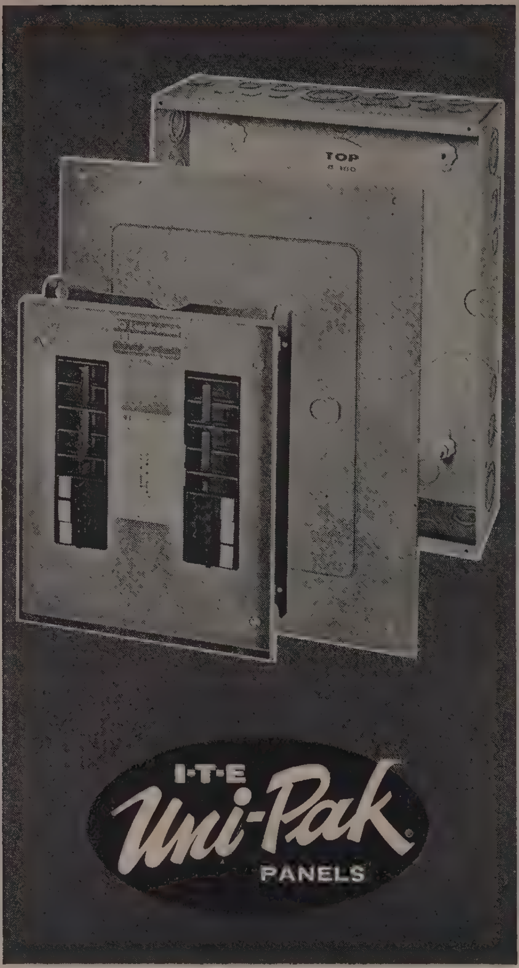
NOW IN SERVICE OVER 600,000 FT. OF SIMPLEX POLYETHYLENE INSULATED POWER CABLE

Voltages from 15 KV to 46 KV

In installation after installation Simplex high voltage polyethylene-insulated power cable has proved itself to be a truly superior product. It combines the advantages of low dielectric loss with high dielectric strength and very high insulation resistance. And it retains these properties under service conditions. Typical applications include direct burial, duct or conduit, aerial and submarine. Write today for complete information.

POLYETHYLENE CABLES BY Simplex WIRE & CABLE CO.

EXECUTIVE OFFICES: Cambridge, Mass. • Plants at Cambridge, Mass., Portsmouth, N. H., Westbury, L. I., Monrovia, Calif.



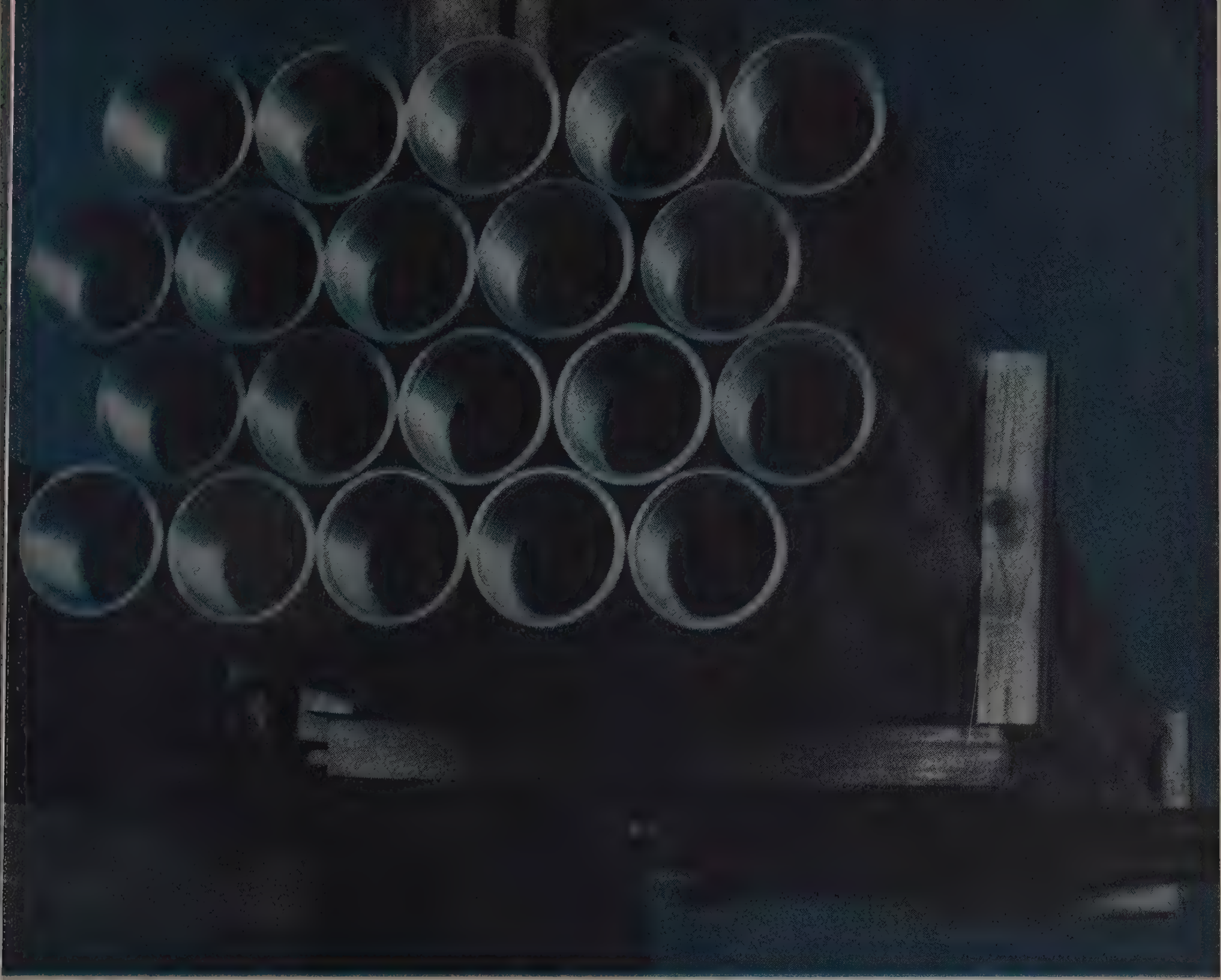
I-T-E CIRCUIT BREAKER LOADCENTERS

Specify I-T-E! Panelboard-type construction assures commercial quality in a residential product! And, separate Uni-Pak packaging speeds installation. First, you mount the 14¼″ Uni-Pak box snugly between 16″ stud centers . . . *hang* either fusible or breaker interior as you would a picture . . . *add trim* and job's done! You do not tie-up working capital if you buy the box, interior and trim separately to install separately. *Write to I-T-E CIRCUIT BREAKER COMPANY, WALKER DIVISION, 125 Bennett Street, N. W., Atlanta 9, Georgia. Ask for the SPEEDFAX CATALOG.*

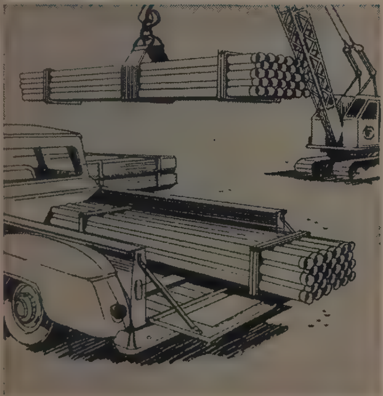
TRIM is flush-to-wall.

for the contractor who is proud of his work!

I-T-E CIRCUIT BREAKER COMPANY
WALKER DIVISION



NOW easy handling aluminum conduit SQUARE-PACK from Alcoa



FAST, EASY UNLOADING with Alcoa's square-pack bundles. They can be picked up in the center, using a sling suspended either from a crane or a boom extension attached to the fork of a lift truck. The lightweight bundles range from 522 to 798 pounds, depending on conduit size, and can easily be handled with a half-ton lift truck.

Here's one way to stack aluminum conduit at the job site and still cut handling costs.

Alcoa® aluminum rigid conduit is now available in convenient *square-pack* bundles, for fast, easy unloading. Held together by steel tape over grooved wood battens, the conduit can be moved from the truck to stacking point in one simple operation.

Economical and safe. Your biggest saving comes from quick unloading—by minimizing handling of individual pipes. In addition, you can expect less damage or loss during handling. When ready for use, Alcoa *square-pack* bundles can be broken simply, by cutting the steel bands that hold the battens in place.

Ask your nearby Alcoa-Rome distributor to supply aluminum rigid conduit in this new, convenient *square-pack*. For detailed information on weights, dimensions and footage, write to Rome Cable Division of Alcoa, Dept. 7-62, Rome, N. Y.

Conforms to ASA C80.5-1960-Rigid Aluminum Conduit and Federal Specification WW-C-540a.

ALCOA
ROME CABLE
DIVISION

The new Furnas Size 4 Magnetic Starter is designed for quick and easy installation. You get 19% more wiring room in the Type 1 Enclosure that requires 16% less mounting area. In addition to these advantages, you get quality Furnas construction and design features that have set the pace for the control industry. Encapsulated dual voltage, dual frequency coils eliminate the chance of coil failure. Large silver-cadmium oxide contacts, standard with Furnas, resist welding and mechanical wear. Truly trip-free thermal relays feature visual trip indicators. Only Furnas offers you a choice of melting alloy, bi-metal compensated or bi-metal non-compensated relays Pushbuttons, selector switches, up to 4 auxiliary interlocks or third overload relay can be added in the field.

- **50 to 100 hp, 2 or 3 poles.**
- **Front removable parts for easy inspection and maintenance. Easily accessible wire connections.**
- **Type 1 Enclosure requires 16% less mounting area, has 19% more wiring room than superseded model.**

FURNAS ELECTRIC COMPANY

Sales Representatives in All Principal Cities

FURNAS

Write today for full information—Bulletin 14-B4.
1067 McKEE STREET, BATAVIA, ILLINOIS

A132

WIREMOLD®
ELECTRIC IDEAS

PREPARED EACH MONTH FOR ELECTRICAL CONSTRUCTION AND MAINTENANCE TO BRING IDEAS, NEWS AND HELPFUL INFORMATION TO ELECTRICAL MEN

63rd YEAR

JUNE 1962

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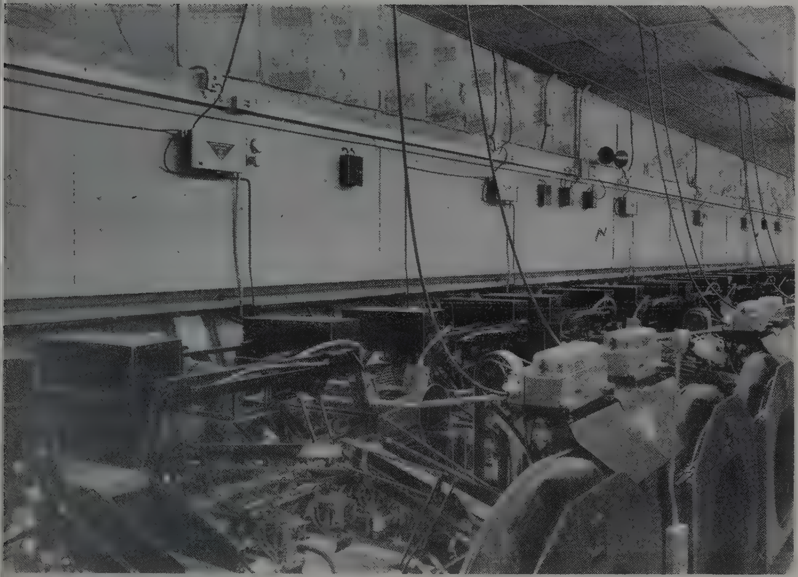
Raceways are a Strike in Wiring of Bowling Alleys



NEW APPROACH to wiring of bowling alleys uses surface raceways as sub-feeder system. Efficient and economical, the system provides built-in flexibility for expansion.

The use of surface wiring as a sub-feeder system for the wiring of automatic ball return and pin spotter machines for bowling alleys proved to be an efficient and money saving approach.

In one case, Hackett Electric of New Britain, Conn., installed the system in a 20-lane alley and, according to Bill Hackett, saved his customer at least $200. He also points out that should it become necessary to get at the wires, the fact that they are not buried in the ceiling simplifies maintenance.

The 800-amp., 225-v. service was brought underground to the main distribution panel in the rear "working area" and set up as a 4-wire, 3-phase system with balanced loads throughout. Eight #6 RH conductors feed into the panel, splitting four in each direction.

A 2-in. conduit goes from the panel overhead behind the ceiling tile. Two circuits, one for each side, are tapped off and fed into a 100-ft. run of Wiremold 3000. Each main circuit is protected by a 70-amp. circuit breaker. The remaining power is used for the front section of the alley or held for future use.

continued on second page

Code Comments

Remote Control and Signal Circuits

Q. *Can conductors of different systems be run in the same raceway?*

A. It is generally good practice to separate low voltage telephone and signal circuits from power circuits to prevent extraneous induced currents from being picked up by the low voltage wires and interfering with communication or delicate signal circuits. Wiremold Tele-Power system will do this very nicely. Since this depends, however, on the individual installation, see Section 725-16 of the Code.

Conductor Size Limit

Q. *What is the largest size conductor that may be installed in surface metal raceways?*

A. Surface metal raceways are restricted to a No. 6 conductor as the maximum that may be installed, according to Section 352-3 of the Code.

Number of Conductors

Q. *How many conductors may be installed in surface metal raceways?*

A. As shown in Section 352-4, "the number of conductors installed in any raceway shall be no greater than the number for which the raceway is designed". This number will be found also in our Wiring Guide, pages 9-13.

WIREMOLD®

Advertisement

Raceways are a Strike

continued from first page

Power for each machine is taken off from the #6s, which are housed in the raceway, fed overhead and then dropped to the unit. The three #12s which feed each 110-v. machine are contained in a flexible cord, to meet vibration requirements.

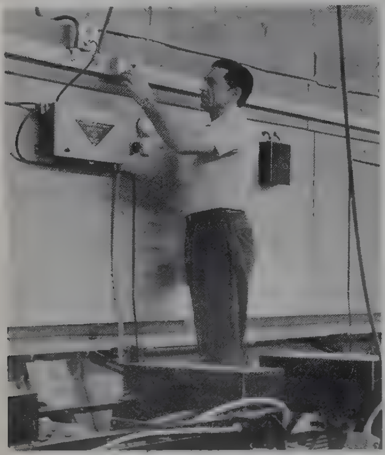
A single-pole cb, mounted two to each 3046KD circuit breaker housing, protects each automatic bowling unit. The breakers serve as disconnect switches as well as for protection.

The raceway also houses four grounding type outlets, two per side, for bells which are used as signalling devices.

In other alleys, surface systems are used for a variety of applications. A run of Plugmold® 2000 is used to bring power to vending and ball polishing machines in one recently-completed alley.

Telephone communication between the playing area and control desk, or playing area and snack bar is provided through Wiremold 2100 at another alley. Again, surface raceways have proved ideal for wiring foul line lights at the same time the system provides outlets for electric floor polishing equipment.

As in other wiring applications where efficiency and flexibility are prime requirements, surface systems are proving a "strike" method.



CIRCUIT BREAKERS, mounted in raceways, are easily reached by man on catwalk. Breakers serve as disconnect switches as well as for protection.

WIREMOLD®

Product of the Month

Fitting for connecting 3000 to panel cabinets

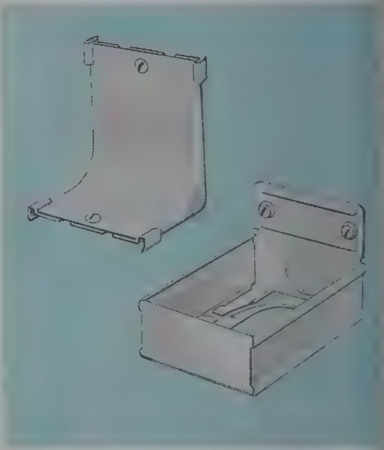
Designed to permit simplified connections of Wiremold 3000 with surface type panel cabinets, the 3086 Adjustable Offset Connector is $1\frac{7}{16}$-in. high without coupling and $3\frac{3}{16}$-in. deep.

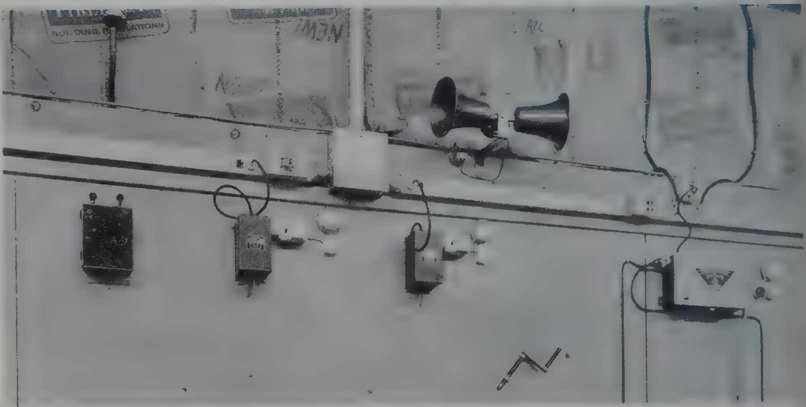
The adjustment from surface to center of bushing is 1-in. minimum to $2\frac{1}{16}$-in. maximum.

The offset connector, like the raceway itself, is made of .040-in. steel and is available in either the standard Wiremold finish or in ASA-61 (20 percent reflectance) gray finish.

The use of this fitting assures a neat, workmanlike job in connecting the 3000 to the cabinet. This combination is frequently used in exposed areas where the 3000 serves as the risers. Because it ties in perfectly with the raceway and cabinet, it makes for a surface-hugging, unobtrusive installation.

Like the majority of Wiremold fittings, the 3086 was created as a result of advice from the field. Its design, therefore, was made to meet contractor requirements.





CLOSE-UP of sub-feeder system shows conduit bringing eight #6s to panel where they split four to a side. Each side is protected by a main 70-amp. breaker.

SURFACE SYSTEMS are finding varied applications in modern bowling alleys. Here Plugmold 2000 is used to bring power to vending and ball polishing machines.

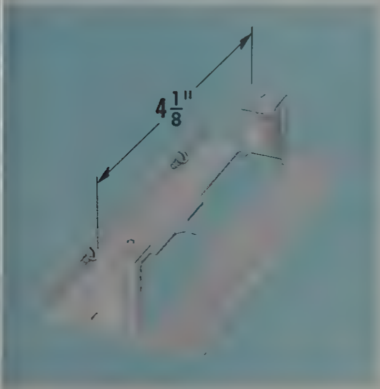
Advertisement

Quiz Corner

Questions for this department are taken from inquiries received from the field. Your questions are welcome; indeed, they are necessary if this department is to serve you with worthwhile information. Address:

Quiz Corner
The Wiremold Company
Hartford 10, Conn.

Q. *What is the best method of mounting devices in 3000 Wiremold?*



A. The 3046 series covers can be used, but the quickest and easiest method is through the use of 3007C device brackets with standard devices and plates.

Q. *Is there a fitting for connecting 1500 and 2600 Pancake to underfloor duct with a 1½-in. opening?*

A. Yes, No. 2657T service fitting.

Q. *When using 2100B and C do I have to cut the cover to fit between the outlets?*

A. No. Cover is scored every three inches. Break off as needed.

Q. *How can 1¼-in. pipe be tied to 3000 Wiremold?*

A. Use 3082 conduit connector with reducer.

Q. *Can 2000 or 2200 Plugmold be furnished with grounding receptacles wired with three circuits so that the outlets would be on the circuits alternated? My customer wants 30-in. spacing.*

A. Yes. Use 30-in. holecut cover and Snapicoil 20GA60 (or 22GA60) alternated with Snapicoil 20G60 (or 22G60).

Q. *Are Plugmold 2000 and 2200 available with outlet spacings other than those shown in the catalog?*

A. Yes, on special order.

Q. *What is the best method of connecting 500 Wiremold at right angles to breaker panel?*

A. Use 5785 combination connector or 5786 adjustable offset connector.

WIREMOLD ■ HARTFORD 10, CONN.
E2-6
Gentlemen: Please send free the checked items

NAME
COMPANY
ADDRESS

☐ Electric Ideas, May, 1962
☐ Electric Ideas, April, 1962
☐ Wiring Guide (Catalog 22)

Noteworthy

More about lumiline fixture

The article on the special 2100 lumiline lighting fixture for electronic cabinets (Engineered Specials, Feb., 1962) inadvertently omitted some salient facts.

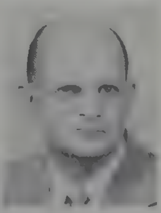
The unit, a special Wiremold 2100 lumiline fixture with reflector, was designed to provide a single source of illumination for reading the instrumentation on electronic equipment located in steel enclosures. The special unit was wired with jacks to allow the technician to plug it into any one of four positions in the cabinet.

The fixture was designed specifically for EMCOR Enclosures by Ed LaKaff, assistant chief engineer of Ingersoll Products, Division of Borg-Warner Corp., Chicago, Ill. Production of the unit was worked out by Wiremold engineers.

Wiremold is pleased to be able to make these additional facts available to you.

Personnel at Meetings

Ken and Bob Hill, both of Elmira, will represent Wiremold at the Pennsylvania Vocational Conference, Forest Hill Casino, Eagles Mere, Pa., June 20-22. The father-and-son team will be in Booth #20.


Ken Hill

Bob Hill

WIREMOLD®

Advertisement

Engineered Specials

Twisted tee for special 3000-2100 installation

PROBLEM:

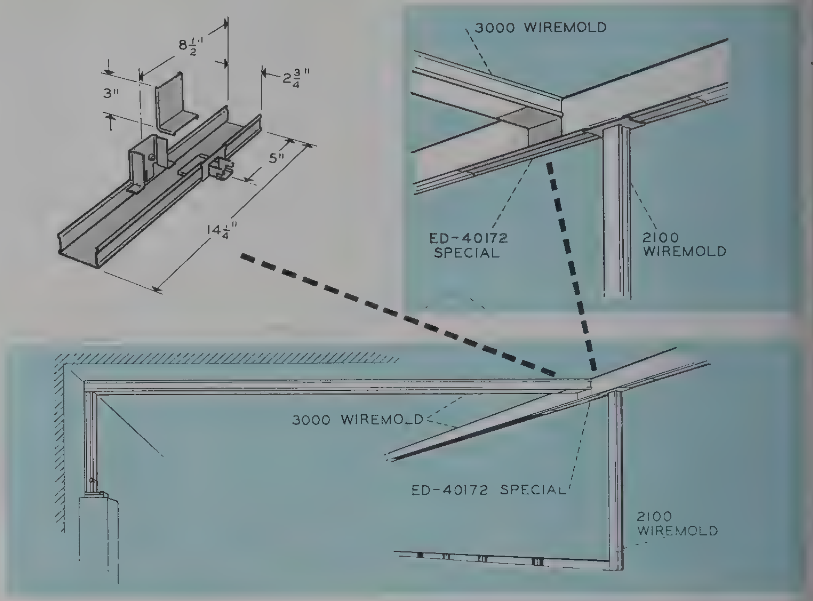
To provide a method of feeding Wiremold 3000 from a panel, across the ceiling to another run of 3000 which has a 2100 branch circuit.

SOLUTION:

A special twisted tee was developed to provide a method of tapping the branch circuit off the 3000.

DISCUSSION:

The ED-40172, developed by Wiremold, permitted the 90° twist with 90° turn from ceiling to side wall. Provision was made in the tee for connecting the vertical 2100 branch circuit run.



Sales Changes

New posts for Ball and Parks

Two major changes have been made in the organization of the electrical division sales department.

William D. Ball moves up to the newly-created post of director of sales. He retains his position as secretary of the corporation.

William E. Parks has been named to fill the spot vacated by Bill Ball. As sales manager, electrical division, Bill Parks brings to the post ten years of experience in sales of Wiremold products. Prior to his selling experience, Bill spent six years in the firm's product engineering department.

Bill Ball

Bill Parks

Practical Tips

610A Cutting Box Assures Square Cuts in 2200

Designed to facilitate the cutting of Plugmold® 2200, the 610A Cutting Box provides an easy method of obtaining straight or mitered cuts.

The sides of the box have slotted guardways for the hacksaw. The tool, a U-channel 12-in. long and 1¼-in. deep, is furnished mounted by lag screws on a 2 x 4-in. block for easy portable use.

The screws serve the dual purpose of securing the box and of acting as spacers which prevent scoring of the channel during cutting.

The box has guides for 90° and 45° cuts. Two additional 90° slots, 7/16-in. apart, are provided in the center for an easier method of mitering corners.

The 610A can be used with any standard hacksaw blade. For best results, use of Wiremold 614A hacksaw blade is recommended. This blade has 40 teeth per inch.

WIREMOLD®

HARTFORD 10, CONNECTICUT
In Canada: Conduits National Co., Ltd.
Toronto 2, Ontario

All WIREMOLD products are sold through electrical distributors — your best source for all electrical products.

Advertisement

who builds the smallest transformers

...we do!

We're talking about our new Class H transformers.

These Hevi-Duty®, dry-type transformers are 17% smaller by volume, on the average, than any other manufacturer's transformers. (Our 45- and 500-kva models do considerably better than the average. They're about 28% smaller than any other transformers with the same ratings. And they take about 13% less floor space.)

You might say they give you less of what you don't like.

Think of what these space-saving transformers can mean to you. Especially in installations where every cubic foot is measured in terms of dollars. Even where space is no object, you'll save time, money and trouble with these easier-to-install units.

And think of these other advantages. Lower case temperatures (40° C. rise max.). Greater overload capacity. Complete vibration damping for low sound levels. Larger wiring compartments. Bottom-mounted terminals.

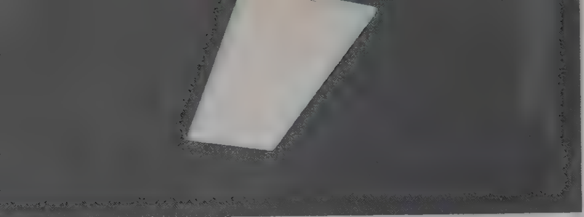
Why wait to start saving? You can get these advanced transformers **now**. In 600v, 3-phase ratings from 30 to 500 kva . . . single-phase from 37½ to 167 kva. Ask your Hevi-Duty transformer specialist for full details. Or write directly to us for Bulletin T-2201.

HEVI-DUTY®

Dry and Oil-Filled Transformers
Constant Current Regulators

BPC

Hevi-Duty
Electric Division
BASIC PRODUCTS
CORPORATION
Box 563
Milwaukee 1, Wis.



Comfort lighting by Day-Brite. Lamps operate closer to rated operating conditions for greater efficiency. Air-handling and static unit are "color matched" for color stability.

It's a lighting fixture...

Engineered air distribution by Barber-Colman. Low-velocity delivery of conditioned air minimizes noise levels. No ceiling or enclosure smudge reduces maintenance costs.

It's an Air Diffuser...

ANNOUNCING THE FIRST ALL-PURPOSE LIGHT-AIR DIFFUSER

Clymatron

TRADE MARK

works 5 ways to offer new versatility in comfort conditioning with light and air

A combined achievement of Day-Brite and Barber-Colman engineering and research.

CLYMATRON is the *first air handling lighting fixture* that can exhaust heat from the room and lamp compartment as it delivers comfort lighting and conditioned air.

CLYMATRON is the *first air handling lighting fixture* to integrate electronic sensing elements for automatic temperature control systems.

Special coated enclosures which reflect infrared energy prevent the majority of heat of the lighting fixture from entering the room. Now you can install more light and reduce air cooling requirements in the conditioned space.

And regardless how the CLYMATRON is used in air-handling applications, the unit is "color matched" to eliminate color shift.

Compatible with all basic ceiling systems and recessed lighting applications, the CLYMATRON may be used individually or in continuous rows. Available in 1'x4' and 2'x4' units.

For new design freedom . . . for a new degree of thermal control of space with higher lighting levels, include the CLYMATRON in your planning now!

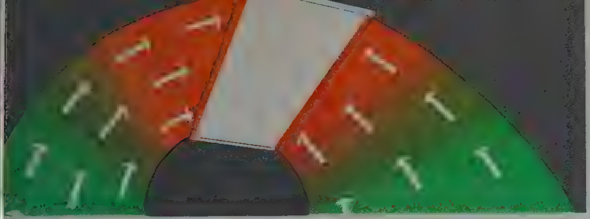
PAT. NO. 2,991,708 OTHER PATENTS APPLIED FOR

DAY-BRITE
AN EMERSON ELECTRIC COMPANY

DAY-BRITE LIGHTING, INC.
ST. LOUIS, MO. • SANTA CLARA, CALIF.

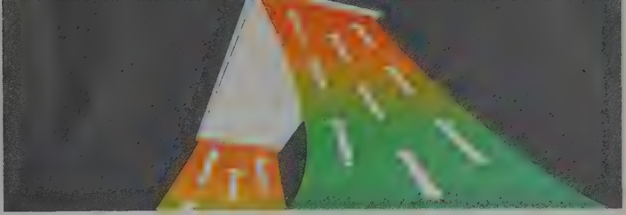
BARBER COLMAN

BARBER-COLMAN COMPANY
ROCKFORD, ILLINOIS



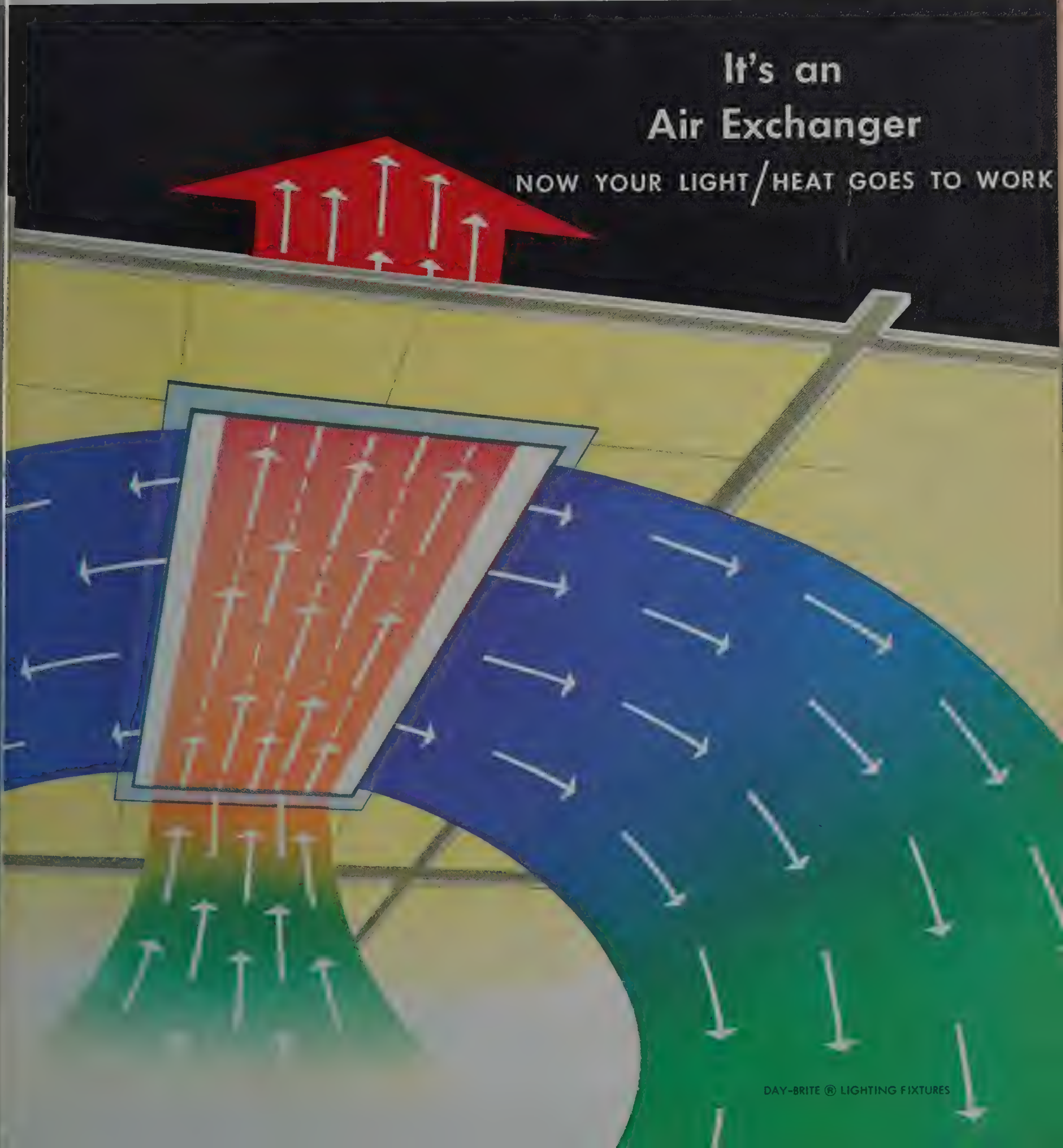
Complete air handling capability—including air return as well as air supply. Interchangeable in any location from the same unit.

It's an Air Return...



Reduce space cooling problems appreciably by extracting lighting heat before it enters the room.

It's a Heat Extractor...



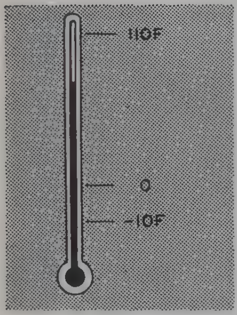
It's an Air Exchanger

NOW YOUR LIGHT/HEAT GOES TO WORK

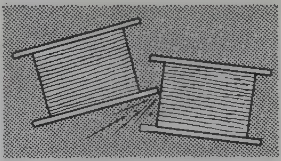
DAY-BRITE ® LIGHTING FIXTURES

CABLE TALK

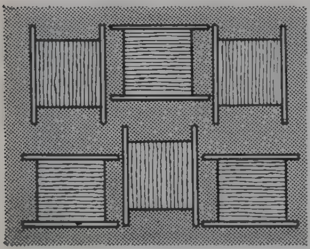
6 tips to help you save money on cable installations

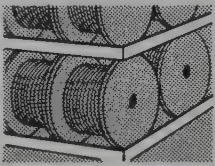


1. Avoid extreme temperatures —below 10F and above 110F (unless cable is specifically designed for this purpose). Low temperatures are seldom harmful to cable, but when they are combined with impact, flexing or other mechanical action, it's possible that the cable may be damaged by cracking, flaking or complete rupture of the coverings. Excessively high temperature, all by itself, can materially shorten the potential service life of stored cable. Thermoplastic components may soften and flow; rubber and many other materials undergo chemical and physical changes at high temperatures. You can avoid this problem by not storing cable near heating units, steam pipes, etc.

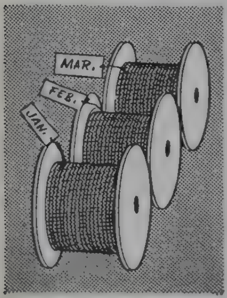


2. Avoid mechanical impact and crushing. Wire on a reel can be rendered useless by allowing the flange of another reel to crash against it. Arranging the stored reels in a crosshatch pattern is the simplest way to avoid this kind of accident. If space is at a premium, the reels may be stored in trays that allow only the flanges of adjacent reels to contact.

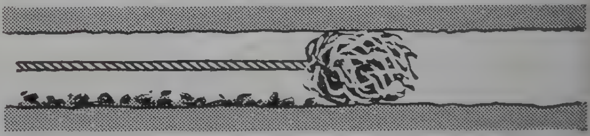




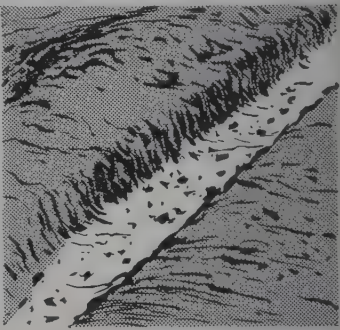
3. Use the oldest stocks first. Very few materials improve with age, so the sooner you use stored cable the longer it will last in service. Also, the less time a cable spends in storage, the less chance there is for damage. Keep rotating stocks so that the newest cable goes to the end of the line.



4. Swab conduit before pulling wire
A remarkable amount of abrasive material—nails, glass and such—can accumulate in conduit, pipe or duct before the wire is pulled through. And pulling a wire or cable through such litter could damage it severely. If you pull a swab through the conduit ahead of the wire to clear the way, you'll eliminate a big source of hidden installation damage.



5. "Direct burial" doesn't mean "on top of anything"
The specification "direct burial" on a cable doesn't mean that you can afford to bury the cable directly on top of whatever you might find in the earth. Trenches should be cleared of rocks and broken glass before the cable is buried. Freezing and thawing can make rocks shift position, and, possibly, exert enough pressure on the cable to cause premature failure. The same danger exists when wires that cross underground rest on each other. Moral: clear trenches before burying cable, bed the cable in sand, and keep crossed cables separated.



6. Pick the strongest component when pulling cable
When wire or cable is being pulled-in, either through conduit or aerially on poles, it's essential to put all the pulling tension on the strongest part of the cable assembly. Ordinary single-conductor material should have pulling tension applied to the bare conductor. Applying tension to the covering materials tends to stretch them, and can lead to breaks in some cases. Always pull preassembled aerial cables by the messenger, not by the insulated conductors. Interlocked-armor cable should never be pulled by the armor, since this may cause severe damage by unlocking the armor.

* * *

This collection of ideas comes from many years of probing into wire and cable problems—and solving them. It's likely that we've come across some problems just like yours, and together we could probably work out a fine solution. So, please give us a call, or write Anaconda Wire and Cable Company, 25 Broadway, New York 4, New York. Department EFL-1-ECM. 61304

ASK THE MAN FROM

ANACONDA®

FOR TECHNICAL ASSISTANCE ON WIRE AND CABLE PROBLEMS

for the easiest, fastest, tightest connections—you need . . .

the WING

—the only built-in wrench, gives you terrific leverage . . . lets you **hand-twist** a perfect connection every time. Quickly splices even the largest, stiffest wires. Wings are easily clipped off for tight spaces.

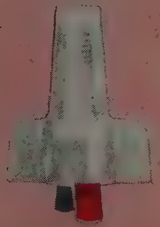
the SPRING

—a tension-spring coil that expands as wires are fed into it—threads and crushes wires together—compensates for expansion and contraction with "breathing" action—a shake-proof, fool-proof lifetime splice.

the NYLON SHELL

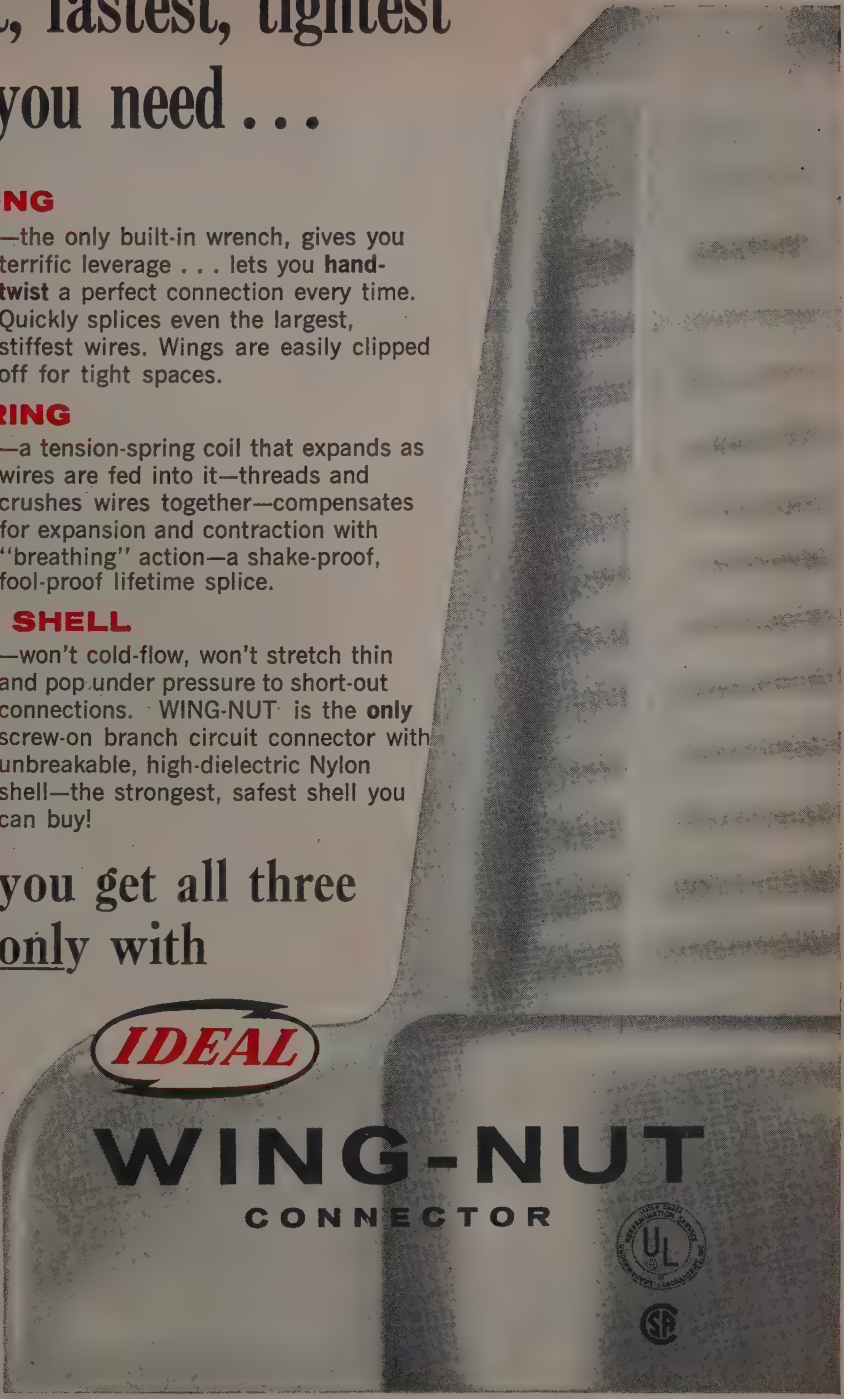
—won't cold-flow, won't stretch thin and pop under pressure to short-out connections. WING-NUT is the **only** screw-on branch circuit connector with unbreakable, high-dielectric Nylon shell—the strongest, safest shell you can buy!

3 SIZES
—fit every branch circuit and fixture hanging need!



WING-NUTS SHOWN ACTUAL SIZE

you get all three only with



IDEAL

WING-NUT

CONNECTOR

Sold through America's Leading Distributors • In Canada: Irving Smith. Ltd., Montreal

Please send me a pocket-full of ***FREE SAMPLES***

Fill in and mail coupon, and Ideal will send you a **pocket-full** of WING-NUTS—plenty to let you see why they're America's most popular wire connector.

IDEAL INDUSTRIES, Inc., 1041-F Park Avenue, Sycamore, Illinois

Name . . . .

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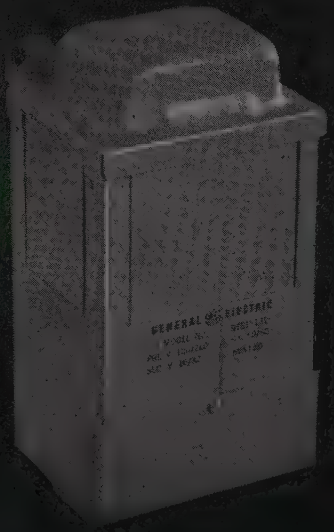
GENERAL ELECTRIC *Announces*

NEW Type H QHT Transformer
37½–167 kva single-phase
30–500 kva three-phase

NEW Type M QHT Transformer
5–25 kva single-phase
3–15 kva three-phase



NEW Type B QHT Transformer
25 va–3 kva

NEW QHT® dry-type TRANSFORMERS

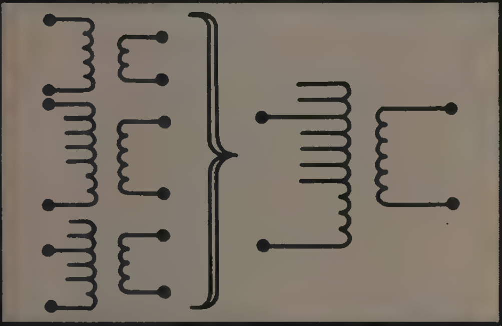
FIRST . . . with all these features:

SOUND LEVELS IN DECIBELS*			
KVA	G-E Average	G-E Maximum	ASA Standard
0–9	37	40	40
10–50	43	45	45
51–150	43	45	50
151–225	43	45	55
226–300	47	50	55
301–500	51	55	60

* Measured per ASA-C 89.1-1961—2.7.3 and 2.7.4.

NEW RATED SOUND LEVELS ARE QUIETER THAN ASA STANDARDS

Larger kva ratings are as much as 10 decibels quieter, and sound levels of smaller ratings are 5 decibels less than former models. As the table at left shows, maximum sound levels of all new QHT units either match or beat the new 1961 ASA standards. And sound levels of the average QHT transformer are even quieter. That's why you can forget about transformer noise when you specify *new* QHT units.



SIX UNIVERSAL VOLTAGE TAPS GIVE 50% WIDER TAP RANGE

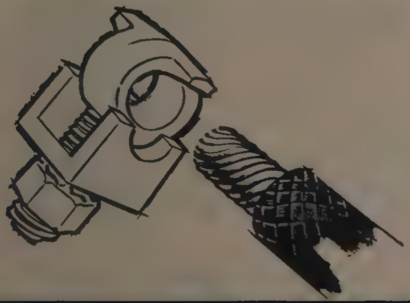
New QHT units 30 kva and up now have six universal voltage taps—four 2½% below normal and two 2½% above normal. This provides a 15% tap range, compared with the usual 10% at *no extra cost*.

As the diagram at left shows, you can now select one transformer rating for a range of voltage levels previously covered by three units. You save ordering time, and you can use the same universal-tap QHT transformer even if your line voltage levels change at some later date.

LISTED UNDER REEXAMINATION SERVICE
UL®
UNDERWRITERS' OF LABORATORIES, INC.

COOLER WIRING COMPARTMENT MEETS REVISED UL REQUIREMENTS

New QHT transformers meet revised Underwriters' Laboratory specifications for applicable ratings. This U.L. listing means that G-E transformers can be connected with any cable of standard temperature rating including 60 C. You can hook up QHT transformers with low-cost, readily available cable—*unrestricted* by cable compartment temperatures.



CLAMP-TYPE CONNECTORS TAKE COPPER OR ALUMINUM CABLE

It's now easier than ever for you to hook up a QHT transformer. Wiring compartments are roomy and all terminations are located at the bottom of the transformer. They are front-connected for easy accessibility.

These clamp-type solderless connectors on type H units, shown at left, facilitate positive connections and will accommodate either copper or aluminum cable.

GET COMPLETE INFORMATION on the revolutionary new QHT line from your G-E distributor or sales representative. Or write Section 411-20, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Architect: Maurice Fletcher, Philadelphia
General Contractor: McClosky and Company, Philadelphia
Electrical Contractor: Harry F. Ortlip Company, Philadelphia
SPANG Distributor: WESCO, Philadelphia

INSIDE THIS SHELL:

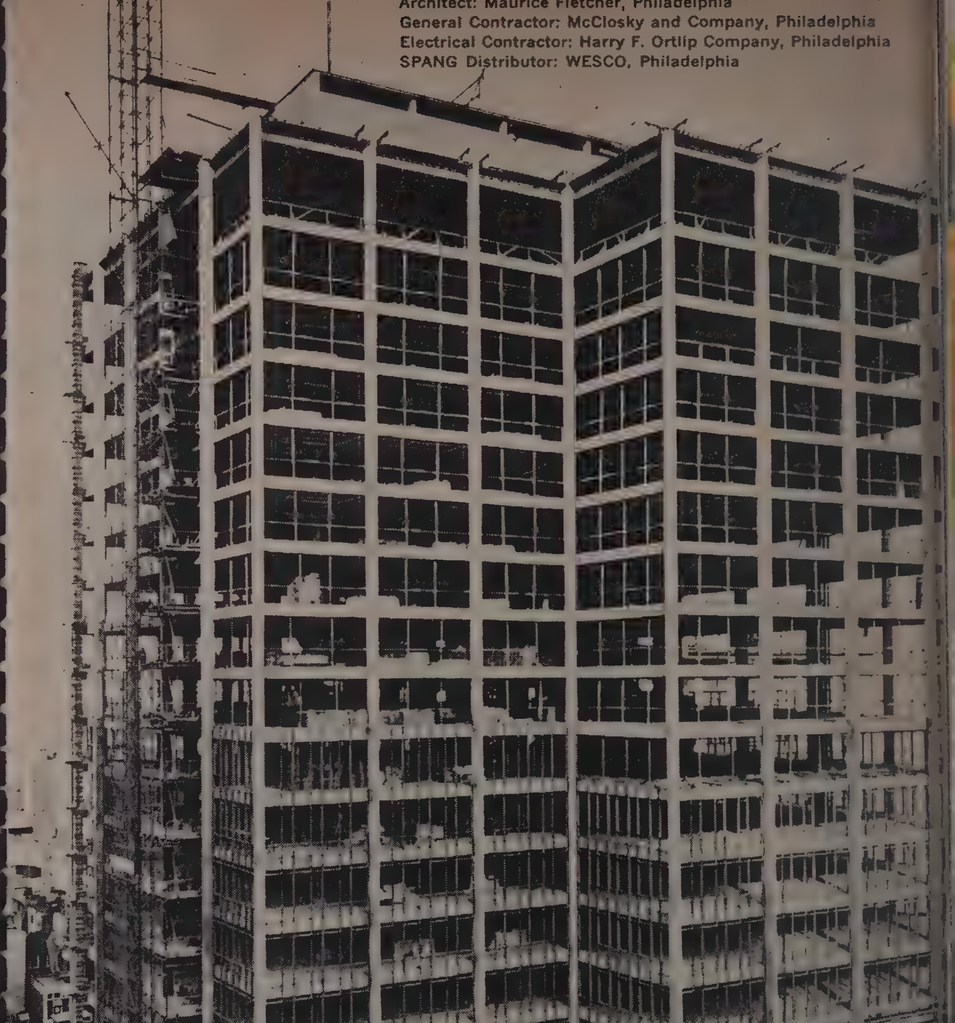
Top-quality wiring protection by SPANG® CONDUIT

This is the framework of Bell Telephone Company of Pennsylvania's new 20-story headquarters building in Philadelphia. And threading throughout this framework is a network of Armco's Spang Hot-dipped Galvanized Steel Conduit, spanGleam EMT and Spang Rigid Aluminum Conduit to provide top-quality wiring protection.

In this $15,500,000 building project, Spang conduit will carry wiring for lighting, fire alarms, control circuits and general power needs. Rigid conduit is used on vertical runs, while electrical metallic tubing is suspended above the finished ceilings.

Spang Conduit and spanGleam EMT, made by Armco, lived up to their fine reputations on this job: fast, on-time deliveries—easy cutting, bending and threading—trouble-free installation—good appearance in exposed locations.

If you're looking for a top-quality, uniform conduit for your next job, make it Spang! And the best man to call for service is your nearby Spang Distributor. For complete information, write *Armco Steel Corporation, Armco Division, Middletown, Ohio.*



Bell Telephone Company of Pennsylvania's new headquarters building in Philadelphia, to be known as Number One Parkway, will be completed late in 1962. SPANG Conduit and EMT will protect wiring throughout the structure.

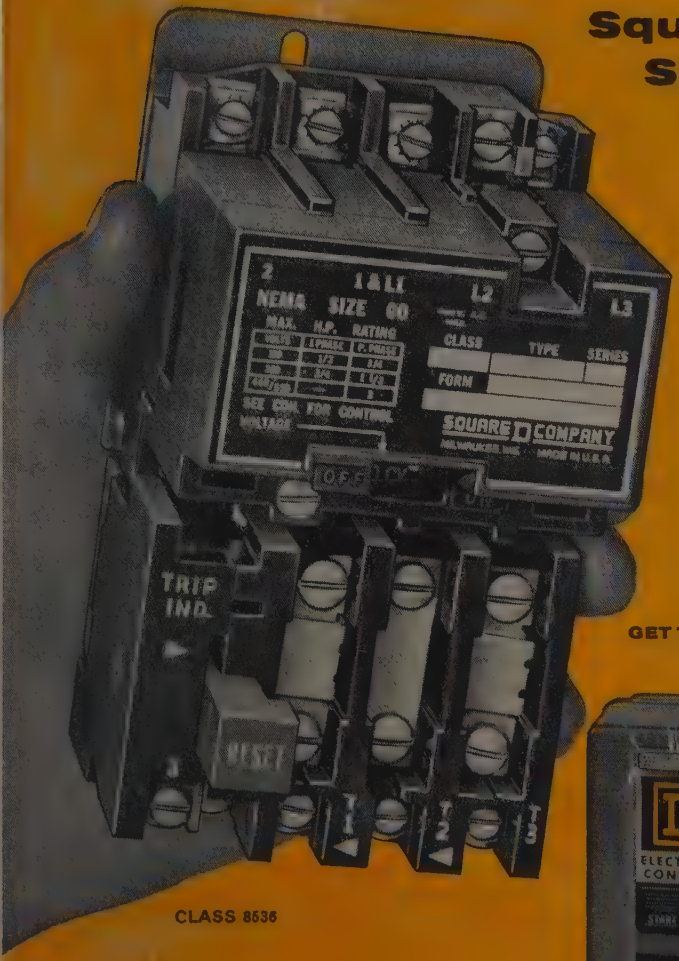
ARMCO Armco Division

NEW SMALL MAGNETIC STARTER COSTS LESS, SAVES SPACE ON LOW-HORSEPOWER JOBS!

Square D NEMA Size 00 Starter Rated ¾ to 2 Hp for 3-Phase Service

- You no longer need to buy more starter capacity than you can use for low-horsepower jobs! This new Square D Size 00 starter is compact, easy to install, simple to use and maintain—and it costs 18% less than the Size 0 starter you formerly had to specify to get the advantages of magnetic control! With no sacrifice in quality, this new starter provides: straight-through wiring—pressure-type terminals—1-piece overload relays for complete motor protection—pushbutton or selector switch optional in the cover. Also available without overload relays.

GET THE COMPLETE STORY! Write for Bulletin SM-297. Square D Company, 4041 North Richards St., Milwaukee 12, Wisconsin.



CLASS 8536

New starter available either open or in NEMA Type 1 enclosure. Enclosure shown with pilot light and start-stop push button in cover. Pilot light or push button available in kit form for easy field installation.

SQUARE D COMPANY

wherever electricity is distributed and controlled

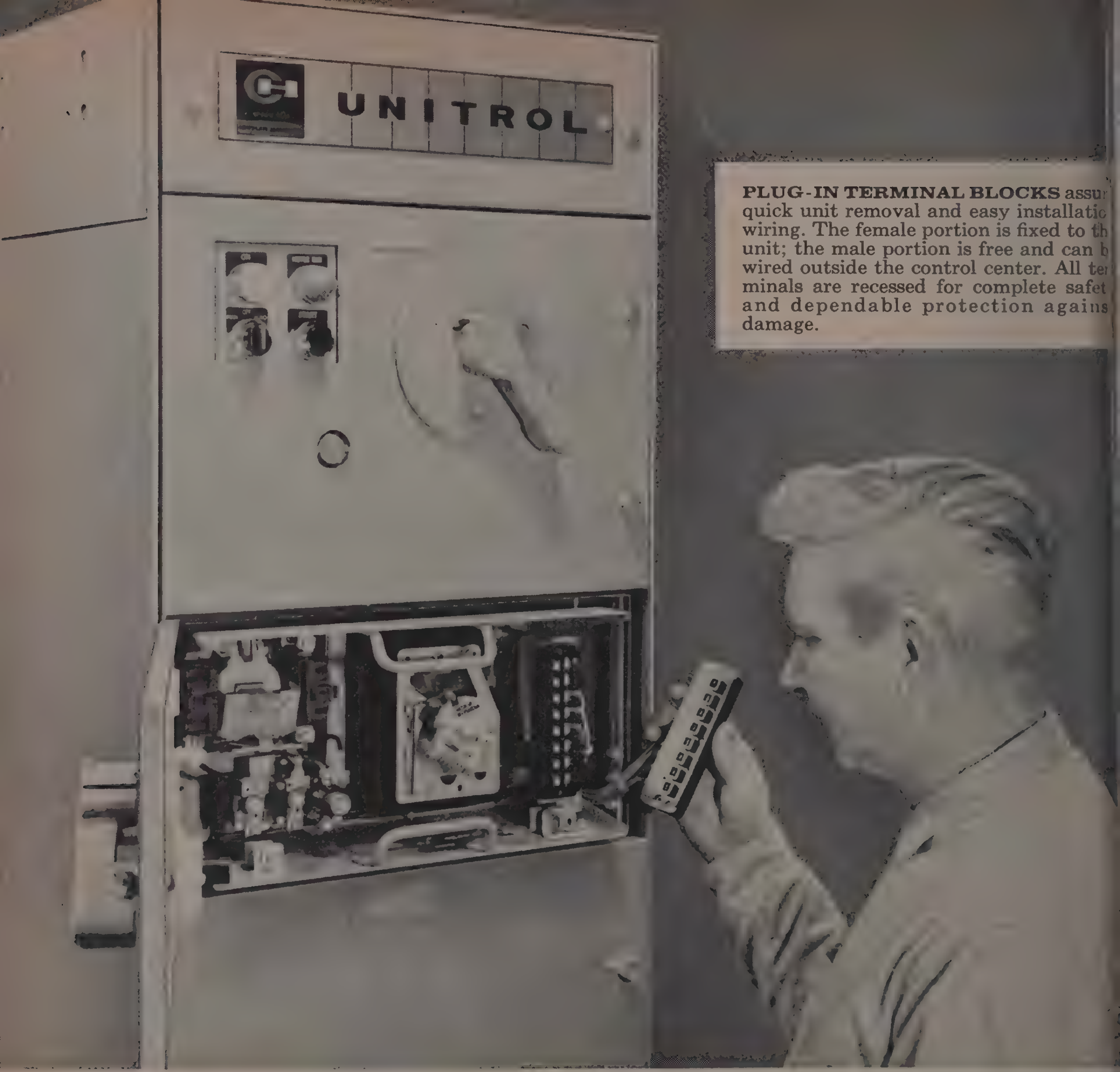
Look at it this way!

No other type of conduit is so easy to thread, costs so little to install

It stands to reason: with a sharp regular die, Alcoa *aluminum* electrical rigid conduit is much easier to thread. And that's only one of the ways aluminum conduit saves time and money in installation. It's much easier to cut, too. Easier to bend. Easier to carry and position, because it's so much lighter. □ Alcoa aluminum rigid conduit is priced competitively. It is naturally corrosion-resistant: needs no painting or other protection. It's non-magnetic. Non-sparking. And it has a smooth, specially-lubricated interior that makes cable-pulling go a little faster. □ In short, Alcoa aluminum electrical rigid conduit makes a better installation at lower cost. Find out for yourself: ask your Alcoa-Rome representative or distributor for the facts and figures. Or write to Rome Cable Division of Alcoa, Department E2, Rome, New York.

CONFORMS TO ASA C80.5-1960—RIGID ALUMINUM CONDUIT AND FEDERAL SPECIFICATION WW-C-540A

ALCOA
ROME CABLE
DIVISION



PLUG-IN TERMINAL BLOCKS assur quick unit removal and easy installatic wiring. The female portion is fixed to th unit; the male portion is free and can b wired outside the control center. All terminals are recessed for complete safet and dependable protection agains damage.

TO PROVIDE UNIT REMOVABILITY without removing control wiring, pushbuttons and lights are mounted on hinged plate.

UNITROL'S PLUG-IN SYSTEM simplifies installation, testing, makes bench maintenance practical.

CONTROL

WHAT'S NEW IN MOTOR CONTROL CENTERS?

New plug-in terminal blocks provide easiest, fastest installation and maintenance with Cutler-Hammer Unitrol

This new plug-in feature—offers these five important advantages:

1. **FASTER, EASIER INSTALLATION.** Terminals can be wired outside the enclosure . . . even with units remaining inside the section.
2. **SAFER MAINTENANCE.** Never any live control wires dangling in the enclosure.
3. **EASIER, FASTER, MORE ECONOMICAL MAINTENANCE.** It's easy to unplug terminal block and move unit to bench for most efficient servicing.
4. **EASY, SAFE TEST.** In safe test position units are disconnected from power bus bars, yet terminal blocks can remain connected for tests of control circuitry.
5. **PERMITS MODERNIZATION OF EXISTING INSTALLATIONS.** There's no "planned obsolescence" in Unitrol. New units with plug-in terminal blocks can be accommodated in existing centers. Future Unitrol units will all be designed for plug-in blocks.

THERE'S MUCH MORE THAT'S NEW AND BETTER . . .

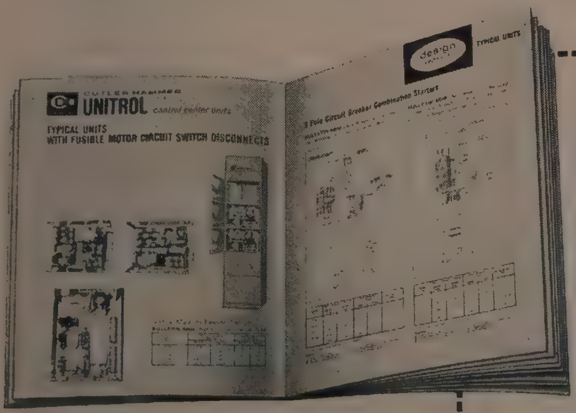
Plug-in terminal blocks are just one of dozens of outstanding Unitrol design features. You get more variety in sizes, more ruggedness, more wiring room, more safety features. Even more important . . . you get *more engineering help* from your local Cutler-Hammer sales office. Call them today.

WHAT'S NEW? ASK . . .

CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S.A.


UNITROL control center units
TYPICAL UNITS
WITH FUSIBLE MOTOR CIRCUIT SWITCH DISCONNECTS
design
TYPICAL UNITS
3 Pole Circuit Breaker Combination Starter

WRITE FOR YOUR FREE COPY TODAY.

New 48-page MOTOR CONTROL HANDBOOK. Not just an equipment catalog, but loaded with selection charts, wiring diagrams, layout and specification instructions and other helpful information. Call your local office and ask for a copy . . . or fill in coupon.

Name____________________

Title__________ Company__________

Address____________________

City__________ Zone____ State__________

M241

REGULAR 66' ROLLS
Also available in
"JOB-SIZE" 44' ROLLS

Now the famous J-M Dutch Brand® Dispenser comes loaded with 11 different tapes!

COLD WEATHER

BLUE VINYL

SILVER VINYL

RED VINYL

TEN IMPORTANT ADVANTAGES OF THIS NEW DISPENSER!

1. Permanently shielded cutter.
2. No moving parts to snag hands, clothes.
3. Can't clog.
4. "Tape-and-tear" with one hand.
5. Special "grip-strip" for faster starting.
6. Contains finest plastic electrical tape made.
7. Preloaded, ready to go.
8. Protects tape against dirt, grease.
9. Big center hole for easier handling.
10. No extra cost.

GREEN VINYL

YELLOW VINYL

ORANGE VINYL

WHITE VINYL

a few short months, J-M Dutch
and Plastic Tape in its handy dis-
iser has become the talk of the
ctrical industry. It is the handiest
e-and-dispenser combination
ilable anywhere . . . the tape-and-
r device that makes a wide variety
jobs so much faster and easier.

Now—Johns-Manville offers you a
oice of eleven different plastic elec-
cal tapes packaged in this great
spenser unit. Here they are:

- Black plastic electrical tape in standard 66′ rolls.
- Black plastic electrical tape in "job-size" 44′ rolls.
- Special Cold-Weather plastic electrical tape in standard 60′ rolls.
- Vinyl tape in eight colors—red, green, orange, blue, yellow, brown, silver and white—available in 66′ rolls.

All of these J-M Dutch Brand tape-and-dispenser units can help you do your job with less effort and more economy! Get the full story from your Dutch Brand Distributor. Or write Johns-Manville, Box 359, New York 16, N. Y. In Canada: Port Credit, Ont. Cable: Johnmanvil.

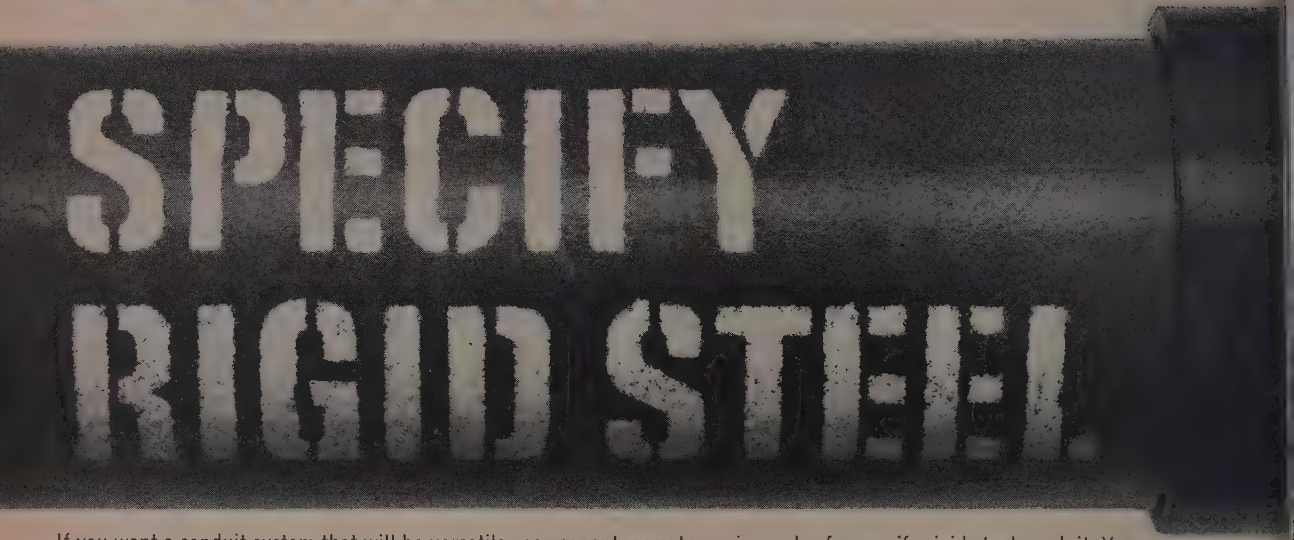
BROWN VINYL

NS MANVILLE
JM
ODUCTS

JOHNS-MANVILLE
DUTCH BRAND TAPE

This mark tells you a product is made of modern, dependable Steel.

specify economical conduit



If you want a conduit system that will be versatile, permanent, easy to rewire and safe, specify rigid steel conduit. You will save money at the start, and you will keep on saving, for rigid steel conduit will outlast the useful life of the building. Here are some of the advantages of rigid steel conduit: **1.** Strength—Resistant to physical damage. **2.** Easy to expand and rewire—because of its smooth interior surface. **3.** Reduces fire hazards and work stoppages due to conduit damage. **4.** Compatible with all building materials. **5.** Quick, easy installation—easy to bend, cut and thread.

You can install rigid steel conduit indoors or outdoors, in dry or wet locations, exposed or concealed, in any hazardous location and under all types of atmospheric conditions. You can bury rigid steel conduit, or run it through or along concrete without organic covering. In addition, rigid steel conduit offers additional safety because it gives a grounded metallic system, so induced currents are drained off without danger. For strength, safety and long life, specify rigid steel conduit.

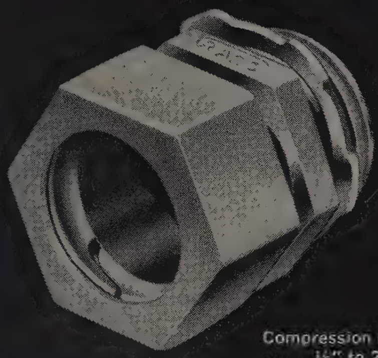
USS and NATIONAL are registered trademarks

America's leading steel pipe manufacturer supplying America's foremost conduit manufacturers.

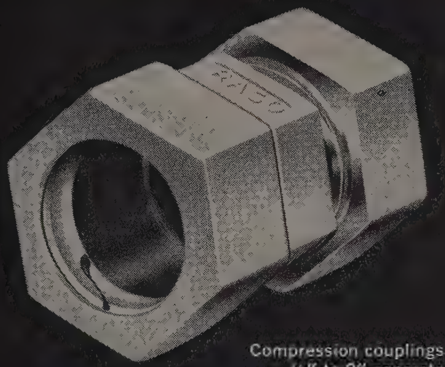
**National Tube
Division of
United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

New RACO E.M.T. Pressure Cast Fittings



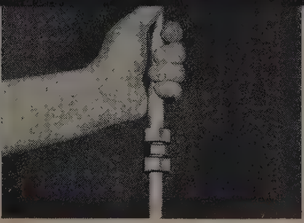
Compression connectors
½″ to 2″ concrete
tight, raintight



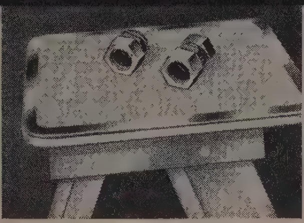
Compression couplings
½″ to 2″ concrete
tight, raintight

QUALITY Fittings with HI-BRITE Finish

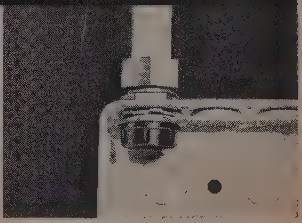
Room for three side-by-side in a 4″ square box.



Finger tighten—E.M.T. won't fall out while installing.



Won't roll—true hex nuts.



Designed to accommodate insulating or capped bushings.

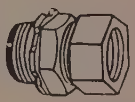
Three RACO E.M.T. pressure cast fittings fit side-by-side in a 4″ square box without any problem. Installation is a snap. Try it with any others—it can't be done. The hand tightened nuts on RACO E.M.T. fittings speed up installation. Here's how. Lengths of pipe can be coupled on the floor, then carried to position.

RACO E.M.T. Compression fittings available in:

Sturdy RACO E.M.T. fittings with true hex nut eliminate any chance of rolling off a ladder. No wasted motion. When needed, RACO E.M.T. connectors are designed to accommodate an insulating or capped bushing with ease. Constructed of sturdy, high quality alloy. On your next job, use top quality RACO E.M.T. fittings with HI-BRITE corrosion-resistant finish.

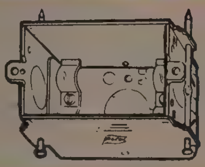
Pressure cast body, steel nuts

Malleable iron, steel nuts

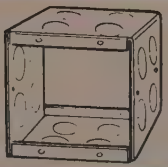


All Pressure cast with insulated throat (connectors)

NEW FROM RACO



Switch box with S "stub" bracket. More wiring room. Staked nails are outside, won't interfere with device.



Two gang masonry thru-the-wall boxes for 4″, 6″ or 8″ blocks—½″ or ¾″ KOs.

RACO

ALL-STEEL EQUIPMENT INC. Aurora, Illinois

click, click: 66,000,000 operations and this starter is still good for more

This Westinghouse motor starter operated in an atmosphere of abrasive clay dust 14 times a minute, 24 hours a day, 365 days a year for *nine* years. That's 66,000,000 operations . . . and it still functions well. Scio Pottery Company engineers at Scio, Ohio, changed the motor size on their basic clay mixer, so they retired the Westinghouse starter that operated it. Instead of scrapping the starter, the chief electrician is counting on using it for emergency replacement!

See for yourself how the Westinghouse motor starter performs better than any other under adverse, demanding conditions. Wherever long life and reliability are vital, specify Westinghouse motor starters. Contact your Westinghouse salesman or distributor for a demonstration that proves its dependability, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa. *You can be sure . . . if it's*

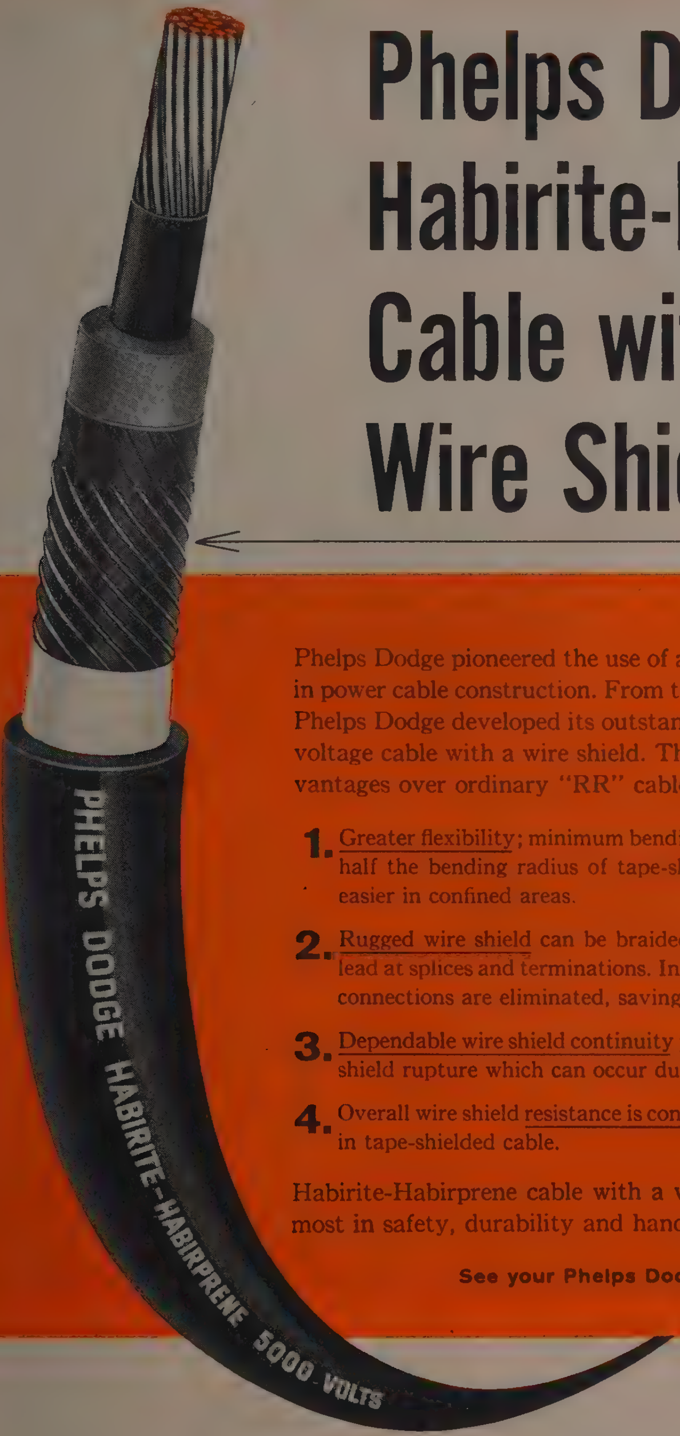
Westinghouse

J-30342

Scio's chief electrician Ross Huff inspects the size 4 starter which worked nine years in demanding, dirt-filled conditions. Reliability is one of the reasons why he insists on Westinghouse motor control.

For contractors who want the finest . . .

Phelps Dodge Habirite-Habirprene Cable with Wire Shield!



Phelps Dodge pioneered the use of a wire shield as a standard item in power cable construction. From this background and experience, Phelps Dodge developed its outstanding Habirite-Habirprene high voltage cable with a wire shield. This cable offers a number of advantages over ordinary "RR" cable with tape shield including:

1. Greater flexibility; minimum bending radius in most cases is less than half the bending radius of tape-shielded cable, making installation easier in confined areas.

2. Rugged wire shield can be braided or bunched for use as a ground lead at splices and terminations. Intermediate steps in making ground connections are eliminated, saving time and effort.

3. Dependable wire shield continuity provides protection against hidden shield rupture which can occur during installation or in service.

4. Overall wire shield resistance is constant without the variations found in tape-shielded cable.

Habirite-Habirprene cable with a wire shield assures you the utmost in safety, durability and handling ease.

See your Phelps Dodge Distributor!

PHELPS DODGE COPPER PRODUCTS
CORPORATION
300 PARK AVENUE, NEW YORK 22, N. Y.

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Des Moines, Detroit, Fort Wayne, Honolulu, Houston, Indianapolis, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., Salt Lake City, San Francisco, St. Louis, Seattle, Tampa, Washington, D. C.

HAVE YOU MISSED THE BOAT...? You have (or will) if you're still using old fashioned metal boxes. Smart contractors everywhere are switching to Union NON-METALLIC new work boxes. You save on the initial cost and more important, you save enough on installation time (as compared to competition) to more than pay for the box. There's no grounding—no box clamps—exclusive plaster seal—handy knock outs. Union boxes are DURABLE—now twice as strong with new Sisal impregnated molding material. Don't forget UNION NON-METALLIC fixtures either. They're non-staining, non-corrosive. They eliminate many grounding problems and have a low unit cost. Complete line — UL approved — Member of NEMA. Contact your distributor now.

UNION INSULATING COMPANY
PARKERSBURG, WEST VIRGINIA

R **AUTHORIZED L-M DISTRIBUTOR** can supply a complete line of ratus and equipment for any outdoor electrical distribution job, plus ype transformers and dustproof capacitor equipments for in-plant ation. Line Material has for years been a leader in outdoor lighting, and provides New Concepts in Styled Outdoor Lighting. In addition, Application Engineering Service is available by L-M Field Engineers and Specialists, who know utility requirements and practices and will be glad to help you, through your distributor, to plan the proper installation.

our Distributor Offers Full L-M Line o Help You Select Electrical Equipment

e Material Industries, leading specialist in outdoor electrical distribution, offers a complete of equipment built to ASA and NEMA standards. Designed for ease of installation, long, uble-free life; excellent performance.

n you select electrical equipment for outdoor distribution, you dependable high quality from the Line Material line. Line erial, for many years a supplier to the utility companies, is well ected by utilities for the quality of its apparatus and materials.

ilable Through Electrical Wholesalers

the complete L-M line is being made available through horized L-M Distributors for industrial and commercial markets.

lication Engineering Help

ddition to the products themselves, Line Material offers excellent application engineering help through your distributor. L-M has more than 150 Field Engineers, Apparatus and Lighting Specialists—graduate engineers who know utility practices and requirements, and who can help you in planning installations to meet all requirements.

Get Complete Information, Catalogs

Ask your distributor for information on L-M's products in which you are interested. If he does not sell the L-M line, call the nearest L-M office or mail the coupon for name of nearest L-M Distributor and bulletins on the products you need. Line Material Industries, Milwaukee 1, Wisconsin.

574

LINE MATERIAL® Industries

cGRAW-EDISON COMPANY

McGRAW EDISON

pecialists in Outdoor Electrical Distribution

ISTRIBUTION TRANSFORMERS · RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS · POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING
E CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE AND CONDUIT

MAIL THIS COUPON

ECM 62

Line Material Industries, Milwaukee 1, Wisconsin

Please send me name of nearest Authorized L-M Distributor and

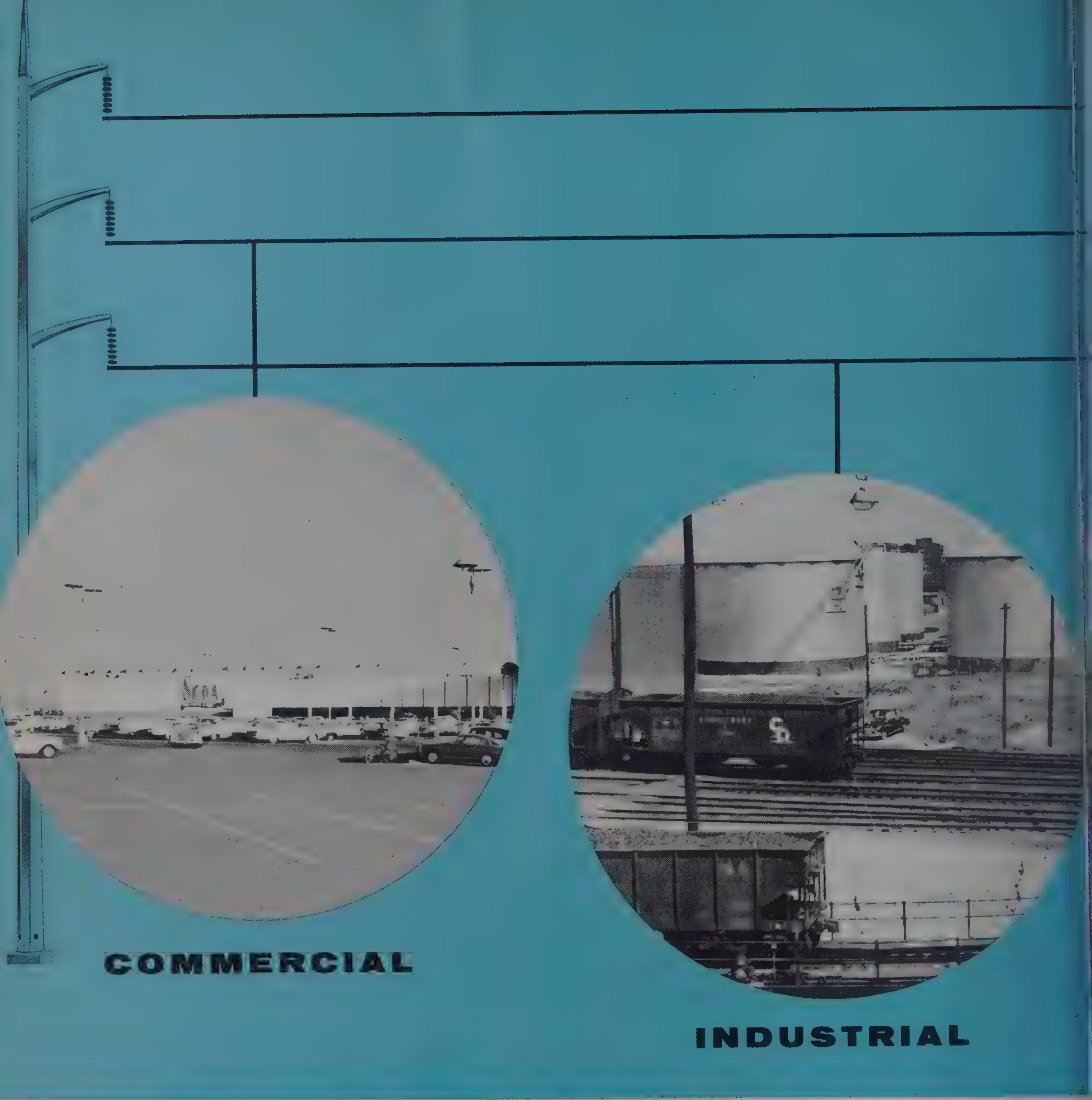
bulletin on________________ (please insert product)

Name________________

Company________________

Address________________

City________________State________________

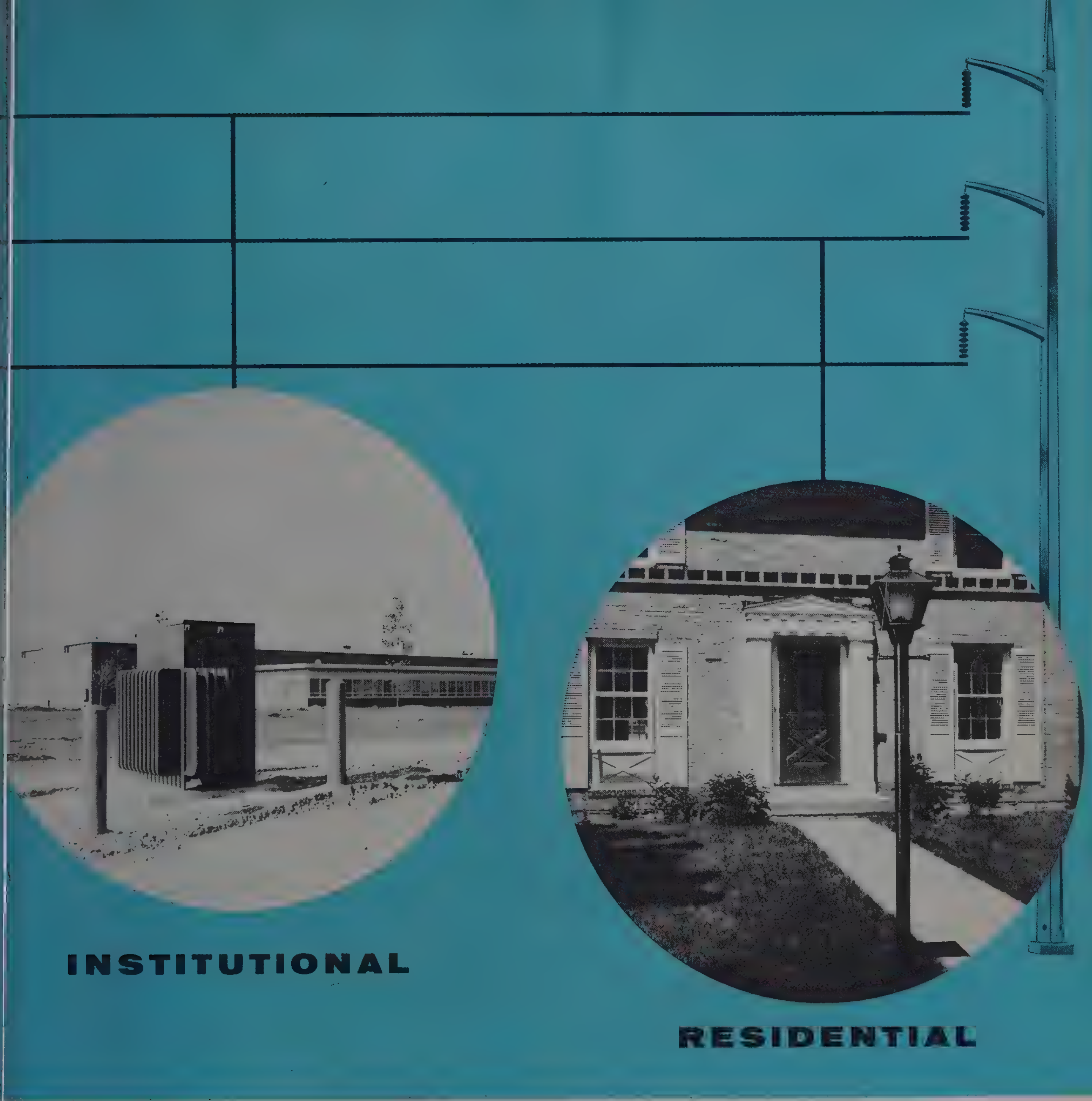


L-M's Full Line Includes Everything For Outdoor Electrical Distribution

For over 50 years, Line Material Industries has been recognized as producer of quality products for outdoor electrical distribution and o door lighting. Starting with a few hardware items, L-M has pioneer many new products and product improvements.

Today L-M's line includes nearly 40,000 items—from a simple lag scr to the biggest electronically controlled oil circuit recloser on the mark

Line Material has 150 trained, experienced Field Engineers and Speci ists, 76 sales offices and warehouses, eight major plants, from coast coast. All are at your service.



L-M Products Now Available To You

- Oil Filled Distribution Transformers
- Reclosers, Sectionalizers and Oil Switches
- Fuse Cutouts and Fuse Links
- Lightning Arresters
- Power Switching Equipment
- Packaged Substations; Feeder-Pak
- Capacitors—power, secondary, dustproof; banks and racks
- Regulators and New "Auto-Booster"
- Line Construction Materials
- Porcelain Insulators
- Fibre Conduit
- Outdoor Lighting
- Airport Lighting
- Dry Type Transformers

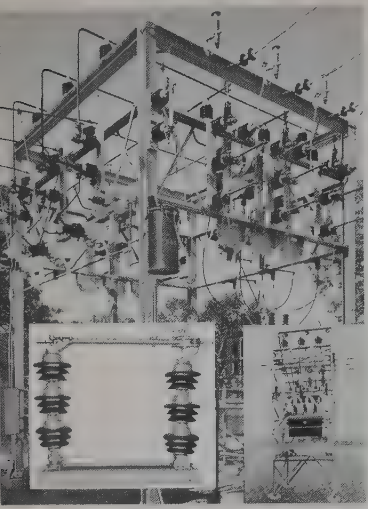
Line Material Industries—THE TIE between your customers and the electric utility.

LINE MATERIAL®
McGRAW-EDISON COMPANY
McGRAW EDISON

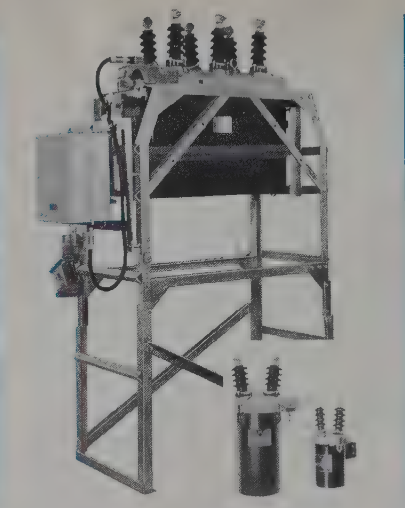
Specialists in Outdoor Electrical Distribution

DISTRIBUTION TRANSFORMERS · RECLOSERS, SECTIONALIZERS AND OIL SWITCHES
FUSE CUTOUTS AND FUSE LINKS · LIGHTNING ARRESTERS · POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS · CAPACITORS · REGULATORS · OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS · PORCELAIN INSULATORS · FIBRE PIPE AND CONDUIT

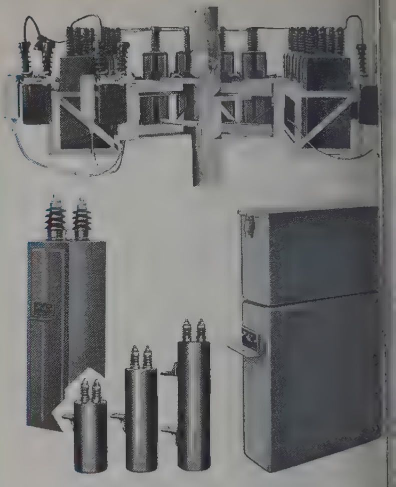
L-M Equipment And Service To Help You On Outdoor Electrical Jo



SUBSTATIONS: everything for the industrial substation—power transformers, switches, regulators, protective equipment; L-M aluminum transmission poles; L-M Feeder-Pak (right).



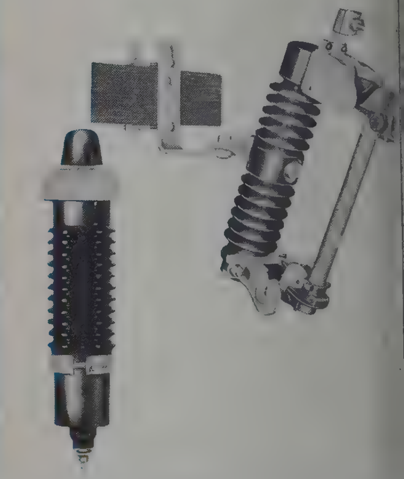
RECLOSERS, OIL SWITCHES, SECTIONALIZERS: complete line, from the 5-amp type H to the big 3-phase electronic type WE with up to 12,000 amperes interrupting rating.



CAPACITORS: compact, light 50 and 10 kilovar power capacitors; racks and banks; secondary capacitors; dustproof equipment for industrial applications.

TRANSFORMERS: pole type distribution transformers in Round-Wound® design for outstanding performance, low losses; standard or custom dry types from 50 va to 3000 kva.

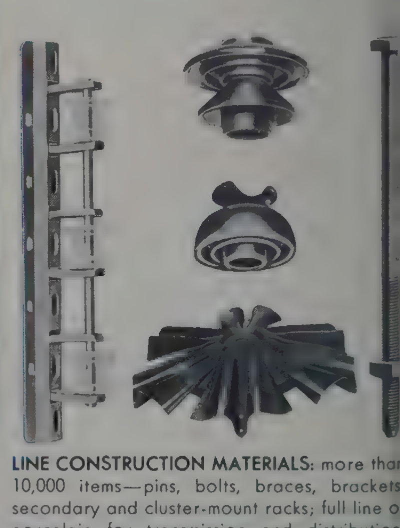
UNDERGROUND: full line for economical underground distribution. The original Pad-Mount(TM) transformer; Transclosure housings; power pedestal; fibre conduit.



PROTECTIVE EQUIPMENT: Full line of open and closed fuse cutouts, including the LMO, outstanding quality leader. Transformer Protector combination; full line of lightning arresters.

REGULATION: L-M's 32-step regulator; the exclusive new Auto-Booster, economical regulation for branch lines; the famous SRT® self-regulating distribution transformer.

OUTDOOR LIGHTING: New concepts in styled outdoor lighting with Styled Mercury, single and twin; Unistyle, PTL, Suburbanaire, and Lawn-Glo luminaires. (L-M Trade Marks)



LINE CONSTRUCTION MATERIALS: more tha 10,000 items—pins, bolts, braces, brackets secondary and cluster-mount racks; full line o porcelain for transmission and distribution

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY

McGRAW EDISON

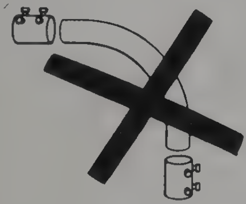
Specialists in Outdoor Electrical Distribution

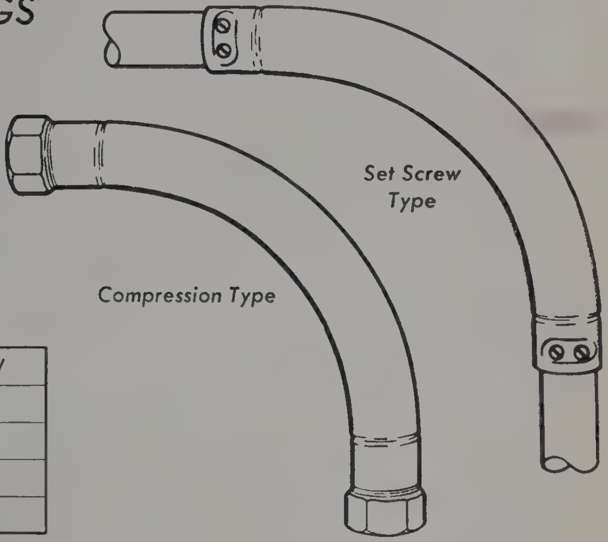
TIME SAVERS FOR YOUR UNITS MANUAL

No. 1

• EMT SWEEP ELBOW COUPLINGS

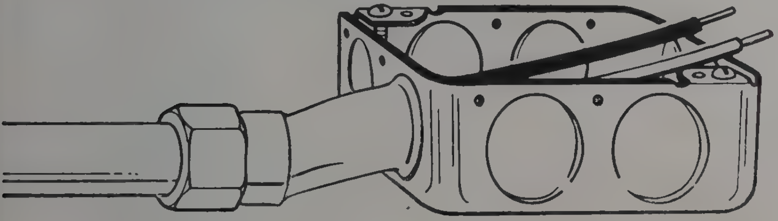
Sweep Elbow Couplings for large sizes of EMT (1" thru 2") are real time-savers. There are no parts to assemble and no bending of conduit required. Installed quickly, same as regular EMT Fittings.



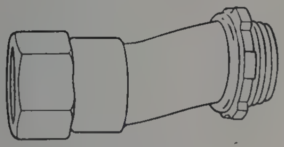


SIZE	COMPRESSION	SET-SCREW
1"	M-163-22	M-162-22
1 ¼"	M-163-23	M-162-23
1½"	M-163-24	M-162-24
2"	M-163-25	M-162-25

• OFFSET FITTINGS



- *Makes Wire Pulling Easier*
- *Protects Insulation*
- *Eliminates Conduit Bending*
- *Speeds Installation*
- *Lowers Costs*



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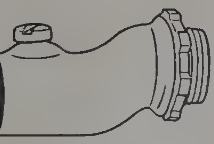

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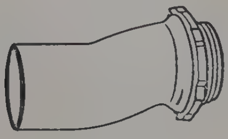
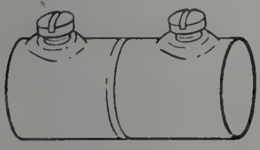


Indenter

• EMT FITTINGS

Steel • Pressure Cast
Combination Pressure Cast and Steel

Know the various types and select the fitting best suited for your job.
Look at this line-up . . . for a complete catalog write to Steel City.



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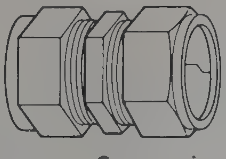

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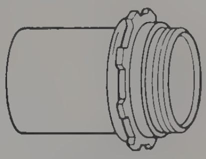

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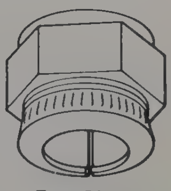


Two Piece

STEEL CITY BRINGS YOU
Better Values in Electrical Fittings

Write for Conduit Fittings Catalog

Steel City
PITTSBURGH 33, PA.

Steel City Electric Co. is a Construction Materials Division of **MARTIN MARIETTA**

CH
CONTROL
CUTLER-HAMMER
RESET
HOW ELSE SHOULD YOU MEASURE A MOTOR STARTER?

CONTROL

WHAT DO CONTRACTORS SAY ABOUT MOTOR STARTERS?

"Sure, quality and performance are essential, but other factors often determine our choice."

Important to be able to pick up the right motor starter when you want it? You said it! It's the only way a contractor can stay in business.

And in a recent study, 254 typical and important buyers of motor starters told Cutler-Hammer just *how* important.

As you'd suspect, the contractors and their customers wouldn't even consider a motor starter that doesn't deliver top performance in reliability, quick installation, easy maintenance, long contact life and so on. And these are standards in which Cutler-Hammer starters have long excelled.

But, said these contractors . . . there's much more to the story. More than half the time, they or their customers chose between motor starters on certain *non-product* measurements.

1. AVAILABILITY

Local stocks are considered a must by buyers. And with Cutler-Hammer, more than 600 distributors maintain balanced stocks. Complete starters or required replacement parts are just a phone call away. They're backed up by 66 district offices and 17 regional warehouses. The 91% of your motor starter requirements that you need in a hurry are available *locally*. Even special requirements can often be handled overnight.

2. SERVICE

Service was the next most-mentioned factor. And you'll find Cutler-Hammer service better than ever. Both the distributor and the Cutler-Hammer man will treat your problem as their own. Together they'll be able to handle your problems—and emergencies—in just hours.

3. COMPLETE PRODUCT LINE

Being able to get the right starter when needed naturally ranks high in importance with buyers. With Cutler-Hammer, you get exactly the starter you need to do the job right. Cutler-Hammer has 10 NEMA sizes, 00 through 8.

For complete details on a starter line designed to industrial standards, proven in thousands of applications and exceeding NEMA requirements in every respect, send for publication LO-70-L241.

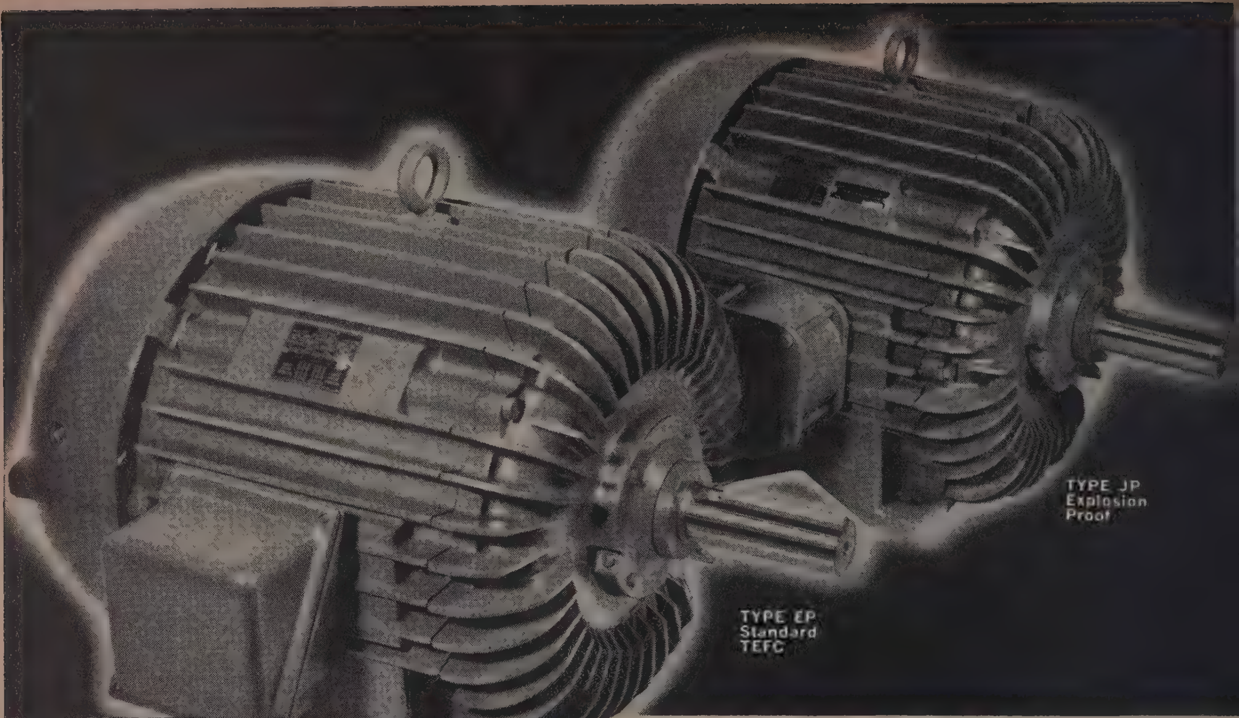
So next time you're talking about motor starters . . . talk to Cutler-Hammer. You know the reputation of our products . . . call your nearby Cutler-Hammer distributor and find out about his service!

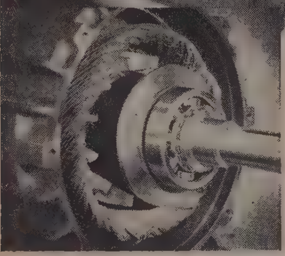
WHAT'S NEW? ASK...

CUTLER-HAMMER

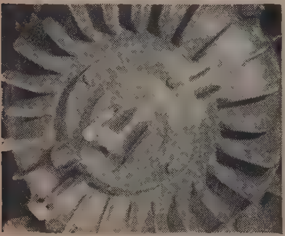
CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach • Subsidiaries: Uni-Bus, Inc.; Cutler-Hammer International, C.A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer, Mexicana, S.A.





HEAVY DUTY BALL BEARINGS. Bearings in these totally-enclosed motors have more than ample capacity to provide troublefree service under the heaviest of loads.



BEARINGS CAN BE RELUBRICATED. Original factory lubrication will last for years in normal service, but convenient grease plugs permit relubrication for severe operating conditions.

SECURELY SEALED FOR LOW MAINTENANCE. Running shaft seals at both ends of motor keep bearings clean. Bearing housings are sealed to prevent escape of grease.

PICK THIS... PROTECTED PAIR FOR YOUR TOUGHEST SPOTS

These Extra-Protected Running Mates Deliver Full-rated Horsepower Under Adverse Conditions

Where dust, abrasives, fumes, steel chips or filings are found . . . these are the spots for Wagner® Type EP totally-enclosed, fan-cooled motors. For hazardous locations, put Wagner® Type JP explosion-proof motors on the job.

These running-mates deliver full-rated horsepower under the toughest conditions . . . keep production up, expenses down. Cast iron housings resist corrosion, and the ribbed frame design adds mechanical strength and increases surface cooling area. Effective cooling adds to motor life, and you can depend on these motors for continuous service at peak output . . . on individual machines or automated lines.

Wagner Type EP and JP motors are built in ratings up to 100 hp in NEMA frame sizes 182-445U. Fully-protected fan-cooled motors with internal ventilating passages are available up to 250 hp. There is a Wagner Sales Engineer near you. Call him, or write us for Bulletin MU-224, for more information about these extra-protected motors.

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.
Manufacturers of LOCKHEED® Products

WM62-9

PYLE VAPORTIGHT LIGHTING FIXTURES

THE PYLE-NATIONAL COMPANY 1344 N. KOSTNER AVENUE, CHICAGO 51, ILLINOIS

NO TOOLS REQUIRED

Stainless steel ball detents allow for snap on and off of guard for easy lamp removal. Reflectors are removable by a 45° turn for convenient cleaning and have four self-locking nylon shoes.

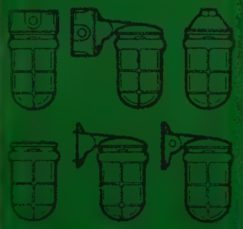
PEC-9 EPOXY FINISH

Corrosion-resistant PEC-9 white coating (standard) protects against salt spray, acid fumes, strong caustics and organic liquids. Eliminates application in field of special compounds.

INTERCHANGEABILITY

The interchangeable straight and 90 degree bracket mounting adapters fit both 100 watt and 200 watt fixture sizes. This allows for better inventory control and easy interchange in the field.

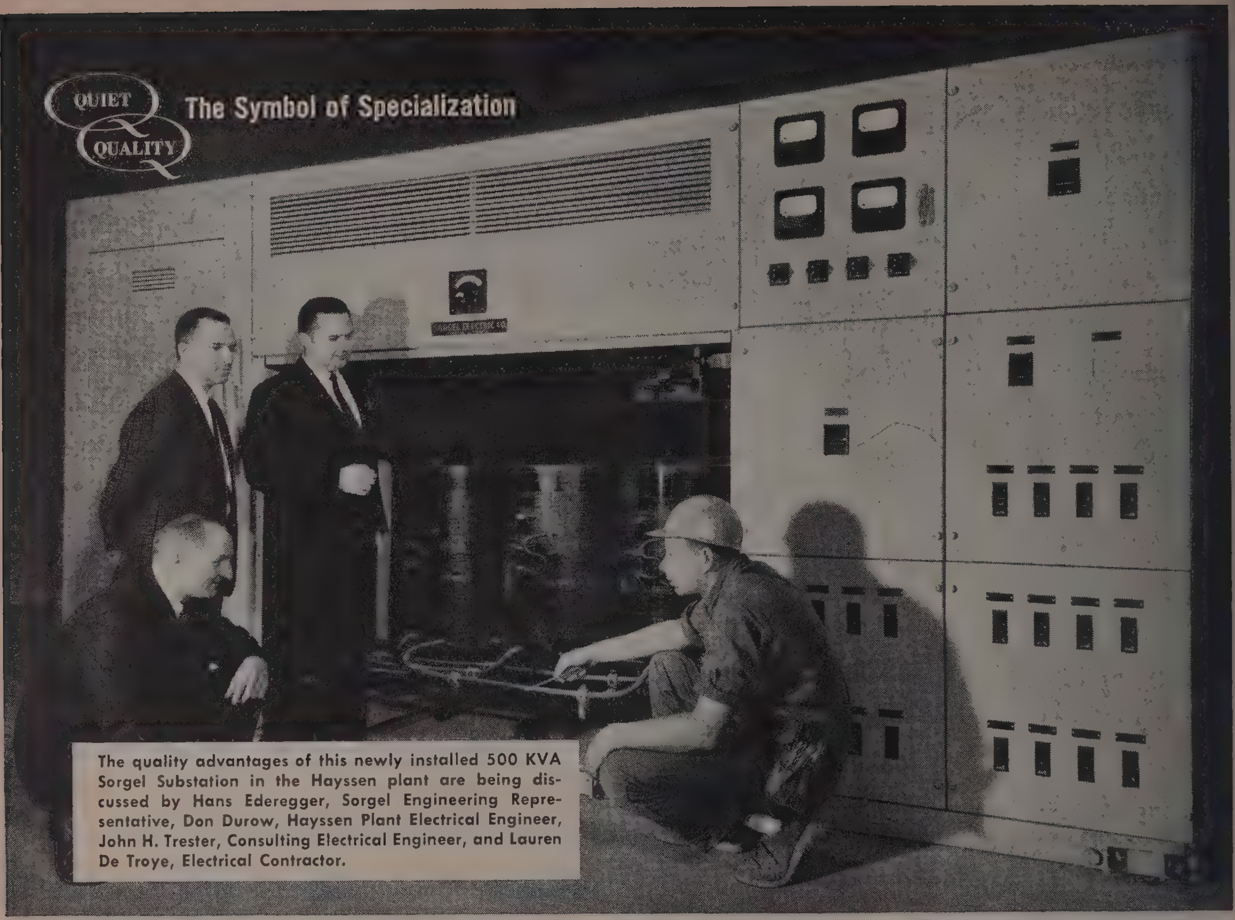
DIE CAST ALUMINUM



ADDITIONAL FEATURES

Heat resistant globes are standard in a choice of colors. Specification grade porcelain lamp grip socket and all white porcelain enameled reflectors. Lamp holder gasket seals off wiring and lamp compartments. All gaskets are exclusively oil resistant nitrile rubber-asbestos compound and are heat resistant up to 800°F. Fixtures are UL listed and meet Navy, Corps of Engineers and General Service Administration specs.

Sold nationally through authorized distributors   Also manufactured in Canada by: Pyle-National (Canada) Ltd., Clarkson, Ontario



The quality advantages of this newly installed 500 KVA Sorgel Substation in the Hayssen plant are being discussed by Hans Ederegger, Sorgel Engineering Representative, Don Durow, Hayssen Plant Electrical Engineer, John H. Trester, Consulting Electrical Engineer, and Lauren De Troye, Electrical Contractor.

ANOTHER EXPERIENCED ELECTRICAL TEAM SPECIFIES AND BUYS SORGEL

In Hayssen Manufacturing Company's new, modern Sheboygan, Wis., plant, the electrical distribution system is of prime importance. In planning, the *plant engineer* insisted on quality dry-type transformers at the heart of the electrical distribution system, as he wanted the utmost in dependability to assure a continuous power supply for all production machinery, lighting, and electrically operated tools. The *consulting engineer* wanted a distribution system that would assure continuity of operation and maximum efficiency at all load conditions. The *electrical contractor* was interested in the kind of economy provided through equipment that was easy to install and guaranteed to perform as rated. After careful comparisons, this team specified Sorgel above all others.

These quality-conscious men liked Sorgel's guaranteed performance data policy and national reputation for designing and providing the finest substations and dry-type transformers. The results are exactly the type of dependable, highly efficient electrical distribution system Hayssen (one of the world's leading manufacturers of intricate automatic packaging machinery) insisted on.

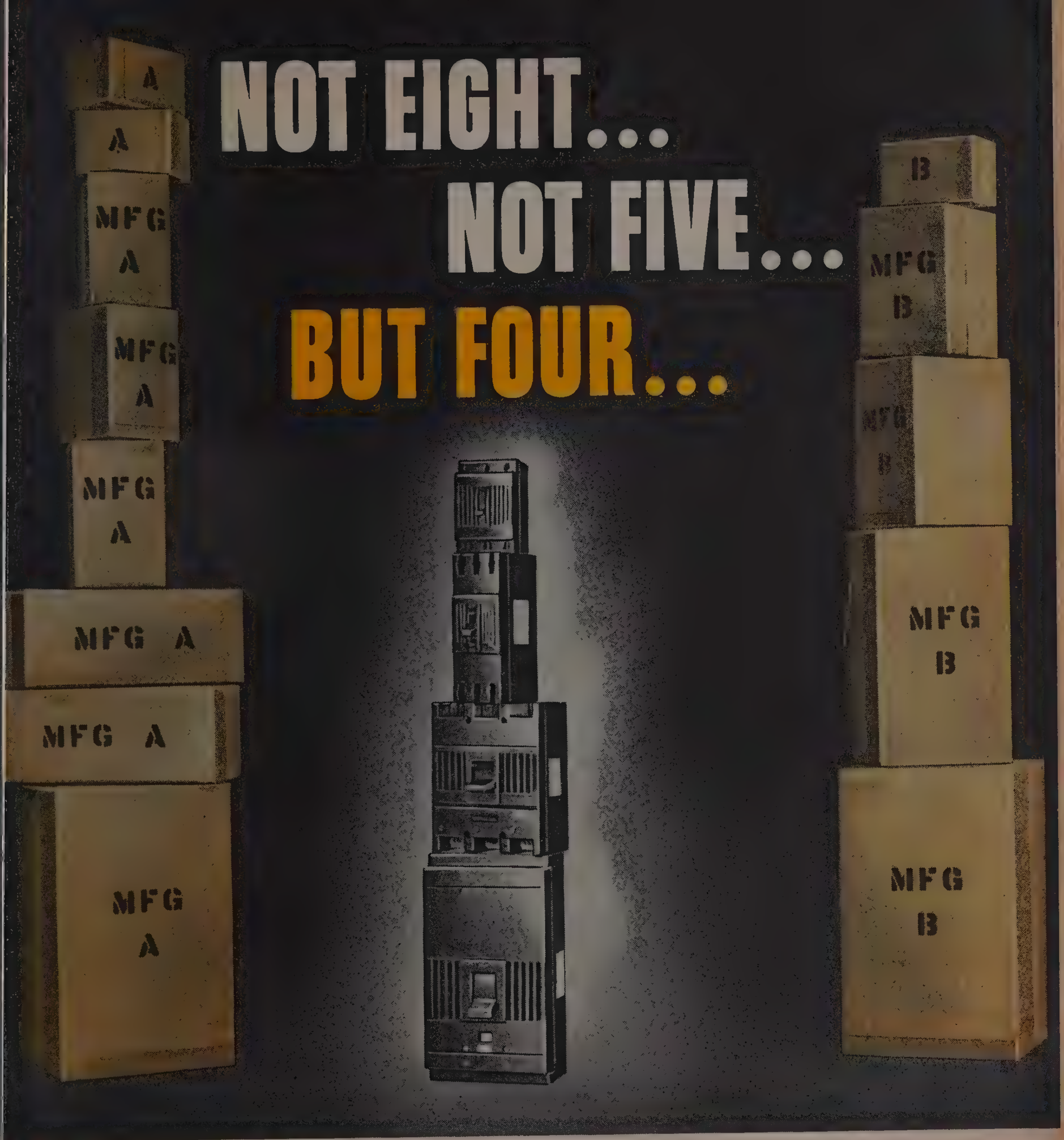
WRITE FOR LATEST SORGEL LITERATURE TODAY.

Complete Line for Every Purpose up to 10,000 Kva, up to 15,000 Volts, Including Special Transformers and Saturable Reactors

SORGEL ELECTRIC COMPANY

836 West National Ave., Milwaukee 4, Wisconsin

Sales Engineers in principal cities. Consult the classified section of your telephone directory or communicate with our factory.



The four basic frame sizes of General Electric molded case circuit breakers cover every need from 15 to 1000 amperes.

Not five or more frames, not a variety of sizes up to 22 inches (G.E.'s maximum is 15½ inches). Just four sizes that make your job of circuit breaker selection easy and simple.

This is the line-up:

E 100 line — 15 to 100 amperes, 240 and 480 and 600 volts
F 225 line — 70 to 225 amperes, 240, 480 and 600 volts
J 400 line — 125 to 400 amperes, 240, 480 and 600 volts
K 1000 line — 125 to 1000 amperes, 240, 480 and 600 volts

There are no special sizes for special applications either. Hi-Break* models (Up to 75,000 ampere interrupting rating) and Vu-Break* models (visible contacts) have same frame dimensions.

New F 225 and J 400 lines feature ambient compensation to 50°C without complex derating...plus adjustable magnetic trip with ±10 percent tolerance at any setting. A full selection of accessories, too.

Easy to select, versatile, compact — all good reasons to standardize on General Electric circuit breakers. Write for bulletin GEA 7410. *Circuit Protective Devices Department, Plainville, Connecticut.* *Trade Mark

GENERAL ELECTRIC

"Extremely accurate,"
Denver sales manager

"Beautiful styling,"
Seattle accountant

3 out of 4 people prefer

Put this over-all preference to work for you with Honeywell electric heat

In a recent survey of homeowners, three out of four, familiar with controls, preferred Honeywell.

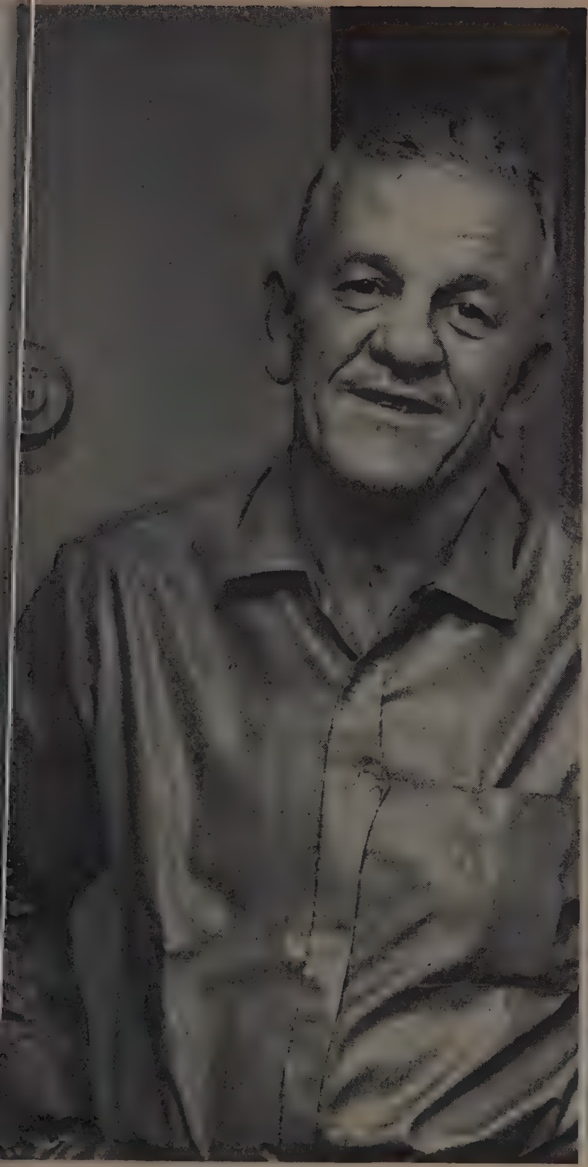
Most of your new customers have lived with Honeywell controls. Shouldn't you put this overwhelming preference to work for you in your installations?

When you combine Honeywell with your own fine brands of electric heating equipment, you've got a combination that can mean more customer satisfaction, easier sales, more profits. Let Honeywell's new electric heat thermostats and new linear limit control join your sales team. They can be a big help.

Low-Voltage Controls let you offer variety

With the Honeywell R8097 Relay, which allows you to use Honeywell's low-voltage controls, you can offer the widest range of low-voltage thermostat combinations in the industry. All the way from the most economical to the famous Honeywell Round to the deluxe thermostats and Control Centers.

Why don't you ask for detailed information on both low-voltage and line-voltage temperature controls now? Just call the nearest Honeywell sales office or write Honeywell, Dept. EC6-24, Minneapolis 8, Minn.



"Mighty reliable,"
Detroit truck driver

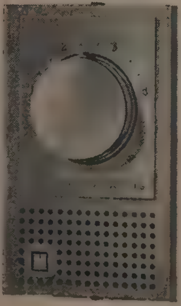
"I'll make my own controls,"
Free-lance scientist

Honeywell Controls

controls, too. They'll help you sell the high quality of your installation.

The new wall-mounted Honeywell T462 Line Voltage Electric Heat Thermostat (and unit mounted T460) give dependable, worry-free performance. The control range is from 40° to 85° with a one-half degree differential.

New, rugged construction makes the units stronger. They are easier to set, rugged and dependable, too. They operate electric heaters up to 5000 watts, responding to both radiant and convected heat. Two switching variations are available in both models. Model T462A and T460C are SPST that make on a temperature fall and provide a line break at NO HEAT. Models T462B and T460D have the added feature of breaking both lines in OFF position.



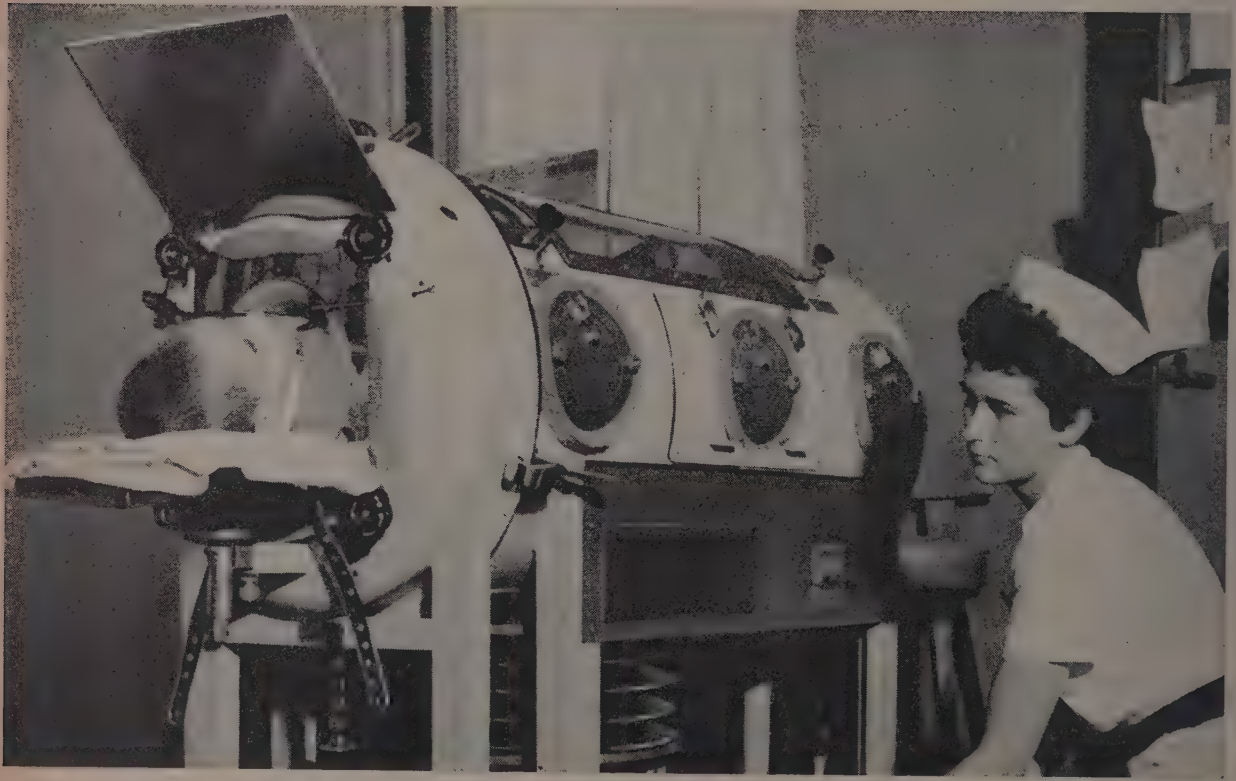
NEW, EXCLUSIVE ELECTRIC HEAT TRAINING PROGRAM! Sales and service meetings studying a new and thorough working manual: "Fundamentals of Automatic Electric Heating." Call the Honeywell office nearest you about the next session.

Honeywell

H HONEYWELL *First in Control*

Is STAND-BY a big enough word
in your POWER PLANNING?

In business and in hospitals, power loss is inconvenient...and expensive!



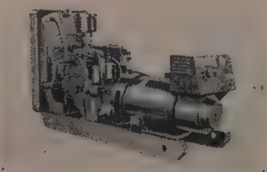
Power loss in hospitals can affect lives. In business, it's usually limited to financial loss. Stand-by power should be available to cover at least the minimum power needs a firm, institution, or place of business requires for continuing operation.

Increasing use of electric and electronic equipment increases power consumption every year . . . requiring additional emergency stand-by power.

When planning your stand-by power requirements, count on Kohler. With a reputation for long, arduous service and reliability, Kohler electric plants supply emergency power and light with units ranging in size from 500 to 115,000 watts, AC. Using gasoline, gas and Diesel fuel, and employing several starting and cooling systems, Kohler units are specifically designed for stand-by use—or as sole power sources.

All units meet NEMA, AIEE, ASA and Canadian Standards Association recommendations. All can be serviced throughout the world. All are famous for dependability.

Engineers: see Sweet's Architectural Catalog and Industrial Construction Catalog or write to Kohler Co., Dept. P-704, Kohler, Wisconsin.



Kohler 35R081, 35 KW Diesel,
remote starting, liquid-cooled

KOHLER OF KOHLER

Kohler Co., Established 1873 • Kohler, Wisconsin

ENAMELED IRON AND VITREOUS CHINA PLUMBING FIXTURES • ALL-BRASS FITTINGS • ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS

solated
wiring
trough lets you lay-in wires, make load and control nnections without disturbing starter units. Helps cut installation time in half. is just one of more than 40 features of the *7700-LINE CONTROL CENTER* ich give you the best protection, fastest installation, simplest maintenance in ouped control. See your G-E Sales Representative or write for Bulletin GEA-7238 to ct. 783-23, Schenectady, N.Y. *General Electric Co., Salem, Va. and Plainville, Conn.*

GENERAL ELECTRIC

Save time and money installing cable in conduit . . . protect cable from damage . . . assure service continuity . . . with a cable lubricant engineered for your job's requirements.

Because conditions vary from job to job—diameter and length of cable, kind of insulation, number of bends, friction in the duct—Burndy provides these **four** tested cable lubricants, for a variety of service conditions. One of the four is the Burndy lubricant for your job . . . ask Burndy to help you select the cable-pulling lubricant you need.

Burndy SLIKON, for cable covered with rubber, many kinds of plastic, or lead, for installation in steel or aluminum conduit.

Burndy ALBENTONITE CABLE LUBRICANT, for cables with polyethylene and similar insulations.

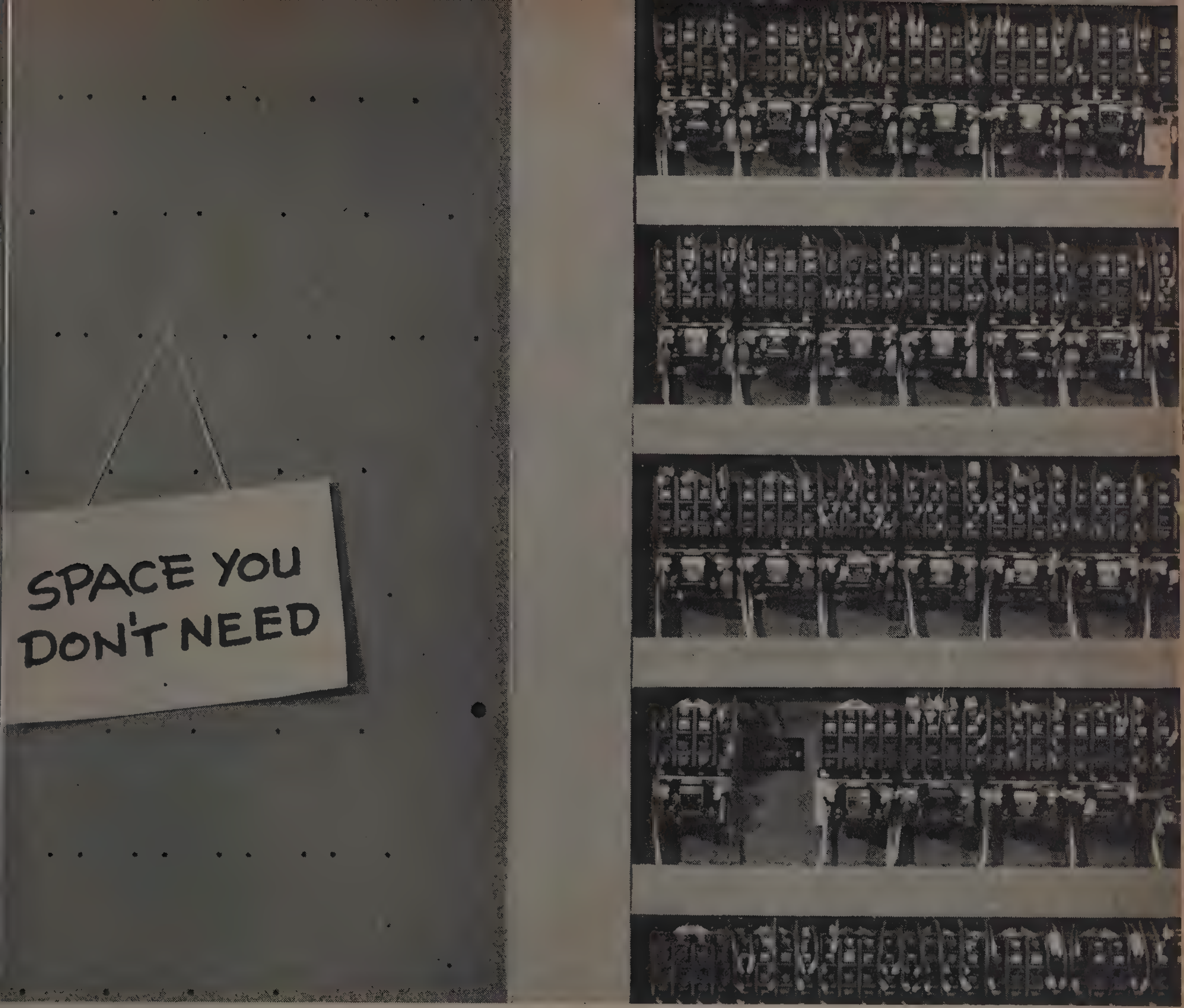
Burndy IMPROVED CABLE PULLING COMPOUND, specifically for lead-covered cable for installation in ducts of all types.

Burndy PROTECTANT 626, for lead covered cable for installation in ducts and manholes subject to flooding and other severe conditions.

BURNDY

61-10

NORWALK, CONNECT. BICC-BURNDY Ltd. Prescot, Lancs., England In Europe: Malines, Belgium TORONTO, CANADA



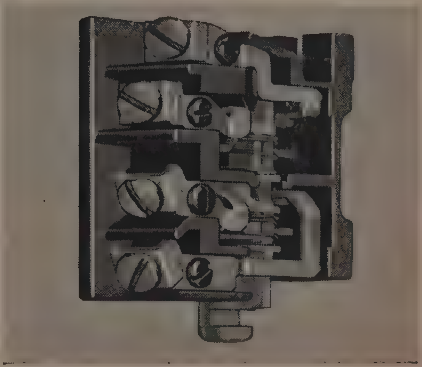
You need only half as much relay space with Clark's new DUPLEX POLE—a relay pole assembly with *two* normally open contacts. It's electrically equal to two normally open convertible poles.

Example: using DUPLEX POLES in a four-pole wide relay now provides *eight* normally open contacts. Before, an eight-pole relay was needed.

This space-saving, cost-cutting development is a product of Clark's concept of modern design, tuned to modern industry's increasing use of electrical controls.

Compare all makes with Clark when you buy or replace electrical controls. Compare for quality construction, ease of installation and repair—for design features that save time, trouble, and money.

And, compare price. Clark controls cost no more.



DUPLEX POLE with two normally open contacts increases design versatility, saves cost, can cut space requirement as much as 50 percent, and mounts interchangeably with standard closed-top poles.

[illegible]

THE CLARK CONTROLLER COMPANY

MAIN PLANT: CLEVELAND, 10 • WESTERN PLANT: LOS ANGELES, 58
IN CANADA: CANADIAN CONTROLLERS, LIMITED, TORONTO, ONT.

Now Sylvania Iodine Quartz lamps have their own built-in protection
(the most concentrated source of incandescent light ever)

There are plenty of good reasons why Sylvania I.Q. lamps are practical to use. They do the work of ordinary incandescent lamps 10 times bigger in size. Their high initial brightness lasts the full life of the lamp. And now Sylvania adds a built-in fuse for extra convenience and economy...at no extra cost.

With new Sylvania Fused I.Q. lamps, there are no special fuses to stock. There's no guessing about what size fuse to use. No premature fuse failures either. Both fuse and lamp are perfectly matched for life and current characteristics.

With Sylvania's exclusive Fused Iodine Quartz lamps, you get the most concentrated source of incandescent light ever. You have fewer maintenance problems. And you save money by using simpler, less expensive unfused fixtures, too. You already have fused fixtures? No problem. Sylvania Fused I.Q. lamps work in any fixture...fused or not.

For more details, call your Sylvania distributor. Or write: Lighting Division, Sylvania Electric Products Inc., Dept. 15, 60 Boston Street, Salem, Massachusetts.

Sylvania Fused I.Q. lamps available now in 500-watt and 500-watt Rough Service types for heavy-duty use. 1500-watt size available soon.

SYLVANIA

SUBSIDIARY OF
GENERAL TELEPHONE & ELECTRONICS

NAUGATUCK CHEMISTRY MAKES THINGS HAPPEN

PARACRIL OZO [illegible] BEL [illegible] DERE, ILL.

Safety, safety, safety!

PARACRIL-OZO Here's safety in a droplight such as you've never seen before...safety in appearance, safety in material, safety in design.

This new and patented LoVOLT droplight and extension cord by Daniel Woodhead Company* has its own built-in transformer to reduce line voltage to a safe 6 volts at the outlet end, eliminating danger of serious shock even under hazardous working conditions.

Molded PARACRIL®-OZO covers form a watertight shield to protect the transformer and light socket units under the severest use conditions...gives the finest possible protection against cutting, gouging, abrasion, weather, and the attack of ozone, oils, fats, acids, and other chemicals.

And PARACRIL-OZO's exceptional color retention allows a bright yellow cover that won't fade or darken, keeps these units visible even in close-to-total darkness.

Next time you need a rubber that's outstanding for its combination of toughness, color retention, and resistance to weather, oils, and chemicals, take a look at PARACRIL-OZO. You'll soon see why so many manufacturers have begun to enjoy the unique selling advantage only PARACRIL-OZO offers.

*Chicago, Ill.

Naugatuck Chemical

Division of United States Rubber Company....Dept. 834 PA Elm Street, Naugatuck, Conn.

DIST OFFICES: Akron • Boston • Chicago • Gastonia • Los Angeles • Dallas • New Brunswick • CANADA: Naugatuck Chemicals, Elmira, Ont. • CABLE: Rubexport, N. Y.

THIS PURPLE LINING MEANS TWO-WAY SAVINGS

1. FASTER, EASIER PULLS: the purple lining means Kaiser KINGFISHER is the only conduit with K-40 silicone . . . the specially developed smooth, hard inner lining that lets cables slip past bends up to 61% easier!†

2. KAISER ALUMINUM'S EXTRAS: this exclusive purple lining also tells you that Kaiser KINGFISHER is the only conduit that saves time and money with: aluminum's light weight, easy threading, uniform bending, and high strength forged couplings.

Only competitively priced Kaiser KINGFISHER has all the advantages of aluminum plus slick K-40 silicone lining. Cut installation costs on your jobs: look for the purple lining and get two-way savings . . . from your authorized Kaiser KINGFISHER Distributor.

† Pull required after fourth bend in standard test comparing other lined and unlined conduits including steel: using 3 #2RHW cables in 1¼" conduit.
* Trademark of Kaiser Aluminum & Chemical Corporation.

KAISER ALUMINUM

1ST YEAR • JUNE 1962

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Trouble Ahead from Grounding Receptacle Rule

Paragraph 210-21(b) in the forthcoming 1962 Code will require all receptacles installed hereafter on 15- and 20-amp branch circuits to be grounding types. The rule is, on the whole, an important step toward improving electrical safety. Industry-wide standardization on the grounding type receptacle is long overdue. For new work, and alterations originating at grounded service equipment, the small additional cost of grounding is of little consequence.

However, the new rule provides for NO exceptions. It applies to all types of work, in new or existing premises, to complete systems or to additions on old branch circuits and even, if taken literally, to replacement of old devices. In neglecting to provide a few minor exceptions, code authorities may have created a monumental problem for thousands of smaller electrical contractors.

Over the United States there are many electrical contractors to whom small repairs, additions and alterations to existing branch circuits are vital, bread-and-butter business. There are, also, millions of homes, stores and offices wired with non-metallic sheathed cable—and some with knob and tube—which have no provisions for grounding beyond the service entrance panel. The new rule can impose an outrageous burden of additional costs on minor wiring changes and cause serious hardship for the small contractors who specialize in this type of work.

The time-consuming, costly task of fishing a separate grounding conductor back to the service or to a water pipe in occupied premises will obviously price a lot of small circuit additions and alterations out of all reason. It will drive customers away from skilled contractors and over to the lamp cord counter in the dime store. To make it more aggravating, in many cases, the grounding feature may never be needed.

Attempts to enforce the rule under these circumstances are bound to produce undesirable reactions. Small electrical alterations may go unreported to inspection authorities. Grounding type receptacles may be installed with the grounding terminal unconnected or, perhaps worse, the grounding connection "cheated" by means of a hidden tap to the neutral conductor.

A simple exception permitting non-grounding type receptacles to be used for replacements and extensions from existing branch circuits, where a suitable ground is not readily available, ought to be written into the rule. It would in no way violate the principle or intent; on the contrary, it would encourage ready compliance and full industry support to an otherwise laudable move in the direction of safer electrical systems.

Wm. T. Stuart

GANGED!... CENTRALIZE YOUR CONTROL. BULLDOG HEAVY DUTY AND GENERAL DUTY SAFETY SWITCHES HAVE POSITIVE, FRONT OPERATED HANDLES FOR "SPACE MAKING" SAVINGS. BUY QUALITY OPERATION WITH PROFITABLE INSTALLATION. BUY BULLDOG SAFETY SWITCHES. CONTACT YOUR I-T-E DISTRIBUTOR OR LOCAL I-T-E SALES OFFICE.

Write for your copy of "The Story Behind the Ad".

I-T-E CIRCUIT BREAKER COMPANY
BULLDOG ELECTRIC PRODUCTS DIVISION
BOX 177 • DETROIT 32, MICHIGAN

In Canada: 80 Clayson Rd., Toronto, Weston, Ont.

Electrical Systems for The Seattle Fair

Highly electrified Seattle world's fair is served by ten miles of primary underground ductwork and 26 transformer vaults providing 12,000-kva capacity for motors, electric heat, air conditioning, cooking and lighting. Electrical designs and installation for 70 structures involved 22 engineering and 35 contracting firms.

By Hugh P. Scott

TALL GOTHIC ARCHES support satellite luminaires above illuminated fountain pools in central court of Science Pavilion. This six-building $10-million complex obtains 480/277-volt power through separate underground 4160-volt feeders, 4000-amp breaker, four 750-kva transformers and three major load centers.

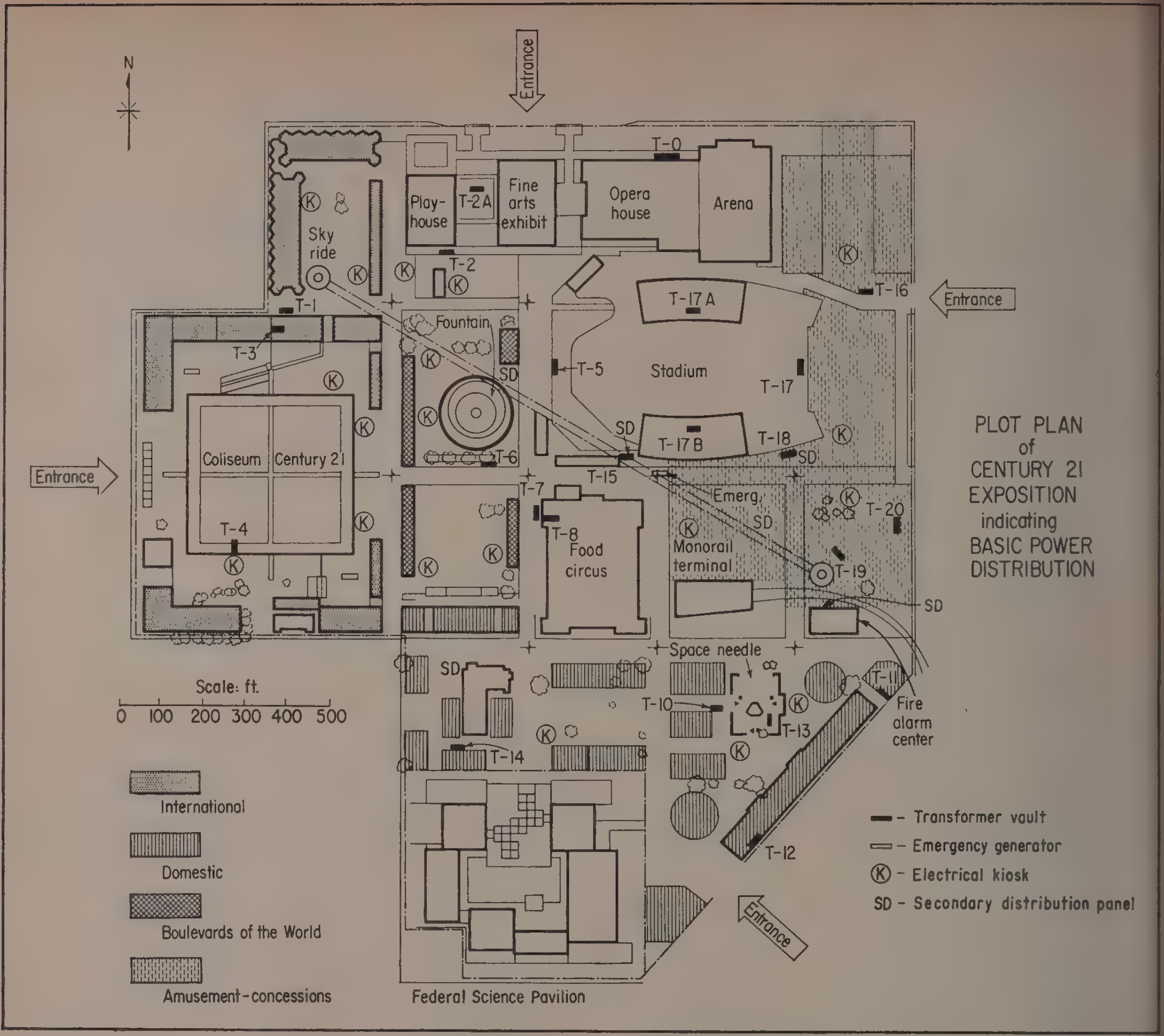
ELECTRICAL systems for Seattle's world's fair are planned for the most part for indefinitely extended service. Many of the 70 buildings erected or modernized for the Fair will remain to form a permanent Civic Center. Long-range quality considerations, therefore, guided 40 architects, 22 engineering firms and 35 contractors involved in electrical work on the project.

The 74-acre Fair site is served by an underground utility cable network and 26 transformer vaults. The total capacity available is 12,000 kva. Load estimates were deliberately upped from early survey findings to accommodate late changes. The resulting actual demand is running a comfortable 80% of capacity.

Primary 4160-volt circuits are carried by 5-kv copper cables, 300,000 and 500,000 cm single conductors, with semi-conducting and copper shielding and PVC jackets. Cables are installed in underground banks of asbestos-cement conduits encased in concrete.

Power is supplied by the Seattle City Light Company from a substation adjoining the Fair. To free the entire area of overhead lines the utility also buried several 26-kv circuits serving surrounding areas.

Although there are a variety of



DISTRIBUTION for 74-acre fairgrounds includes nearly ten miles of underground ducts carrying 4-kv primary utility power to 26 transformer vaults, plus separate emergency service to eight locations. Secondary control switchgear is located in all major buildings, while control of exterior electrical facilities is obtained from distribution centers in local kiosks, many of which contain photocells, relays and clock mechanisms for automatic switching.

vault layouts, a typical vault can be described. Primary cables are terminated in single-conductor potheads. Each conductor then goes to a fused oil cutout, then to the transformer primary. The oil cutouts are gang-operated.

Transformer banks typically 500 kva, include single phase, liquid-filled, subway types grouped for delta-wye connection. Secondary connections, usually 120/208 volts, are extended through walls of the vaults by busway to distribution switchboards located outside the transformer vaults.

Emergency power and light circuits are supplied by an independent system. Eight transformers are fed by 5-kv, No. 8 cables installed separately. In a centrally located structure, transfer switches normally connect the emergency system to the utility supply. In the event of power failure, the emergency system is automatically switched to a large diesel engine-generator installation.

Secondary distribution panels in the substations are equipped with fusible links in the branch feeder bus bars. Feeder lugs are attached to the bus with captive bolts.

Hundreds of circuits, supplying floodlights, concessions and other facilities outside the major buildings are controlled from novel kiosks of which about 24 are distributed over the grounds. Kiosks are cylindrical, brightly lighted by bracket fixtures extending out from circular roofs. Inside are circuit-breaker panelboards with magnetic contactors to control groups of circuits. Photoelectric devices and clock-operated switches provide for unattended operation of many lighting circuits.

Eye of the Needle

To many visitors the dominant structure is the 600-ft-high $4-million Space Needle, crowned by a glass-enclosed restaurant, cocktail lounge and observation deck. The outer 14-ft portion of the restaurant floor revolves at a rate of one revolution per hr. The inner 66½-ft-diameter core remains stationary.

This movable floor section together with 220 diners and tables weighs approximately 90 tons. It is driven by a 1-hp motor through an 800:1 reduction gear.

Power at 460 volts from a basement vault operates elevators, pumps, fans and electric heating coils. Low-noise-level transformers mounted on rubber reduce voltage to 120/208 volts for kitchen and lighting panels. A dozen 100-va 115/12-volt transformers regulated by dimmers supply power for low-voltage lighting effects in the revolving dining sections.

Wiring is carried upwards through the core of the tower in aluminum rigid conduits clamped at intervals to inner stringers of an open stairwell. Conduit supports consist of double U-bolts snugged against channels welded to stringers. Additional single U-bolts are installed at intermediate stringer positions for guide purposes only. Expansion fittings are located beneath conduit supports, with expansion heads in the down position, while cable supports are raintight split-wedge assemblies. Cable and conduit supports alike are bonded by aluminum jumper straps.

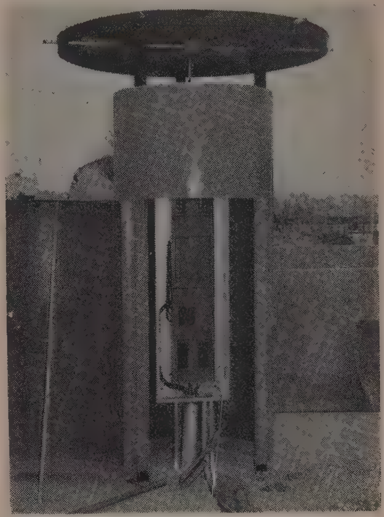
The Fair's famous monorail is electrically operated. Two 4-car, 450-passenger trains shuttle between downtown and the exhibition grounds, a distance of 1½-miles, in 96 seconds.

Each train is powered by eight 100-hp 600-volt dc electric motors. Power is supplied through contact shoes sliding on copper-clad galvanized steel trolley rails mounted alongside the beamways. The rails are suspended from insulators on 8-ft centers.

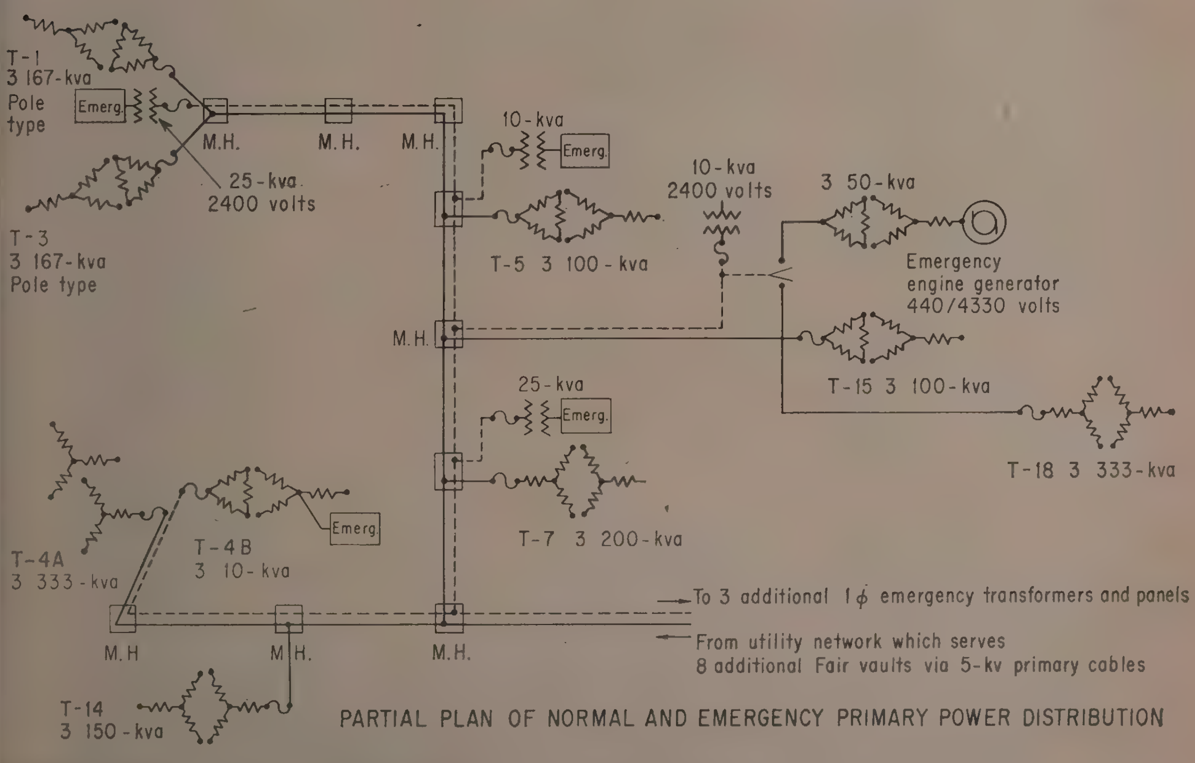
Pairs of open, insulated No. 10 wires installed along beamways provide speed-controlling signals. The signals compel operators to obey prescribed speed regulations. Standard railway control circuits likewise are provided for signaling and emergencies.

An outstanding group of buildings is a 6-unit $10-million U. S. sponsored Science Pavilion, which

SUBSTATIONS range in capacity from 300 to 1000 kva; generally grouped subway-type single-phase transformers with secondaries connected by busways to switchgear on other side of the wall.



CONTROL KIOSKS enclose breaker panels and relays for light and power in open areas and controls for automatic operation of many lighting circuits. (Shown with hinged front open.)



PARTIAL PLAN of normal and emergency systems.

LOOKING UP through open stairwell shows arrangement of enclosed cable supports, expansion fittings and bonding jumper straps. Conduit couplings are staggered to preclude interference with supports, while supports are distributed between stair stringers to apportion weight.

is served by a 4160-volt underground service. This service is from a convenient utility network substation, completely independent of the general primary distribution system mentioned previously.

Power is stepped to 480/277 volts through four 750-kva transformers. It is delivered to a main switchboard through a 4000-amp circuit breaker and a ventilated busway. Circuits of cable in conduit run through tunnels to three load centers. Power is then distributed to power panels, compressors and, through three 500-kva dry-type secondary transformers, to 11 local 120/208- volt lighting distribution panels. Secondary sides of the three lighting transformers are connected through circuit breakers to permit bypassing any one of the units in event of a partial outage.

For emergency 120/208-volt use, a fourth dry-type transformer is provided, connected at the main switchboard to the supply side of the main breaker.

Numerous pools and fountains around the Science group of buildings influenced electrical design. Conditions dictated wiring methods resistant to moisture and thoroughly grounded.

To meet these conditions, special cable insulation was specified and locally approved. Designation of this insulation is RHWN.

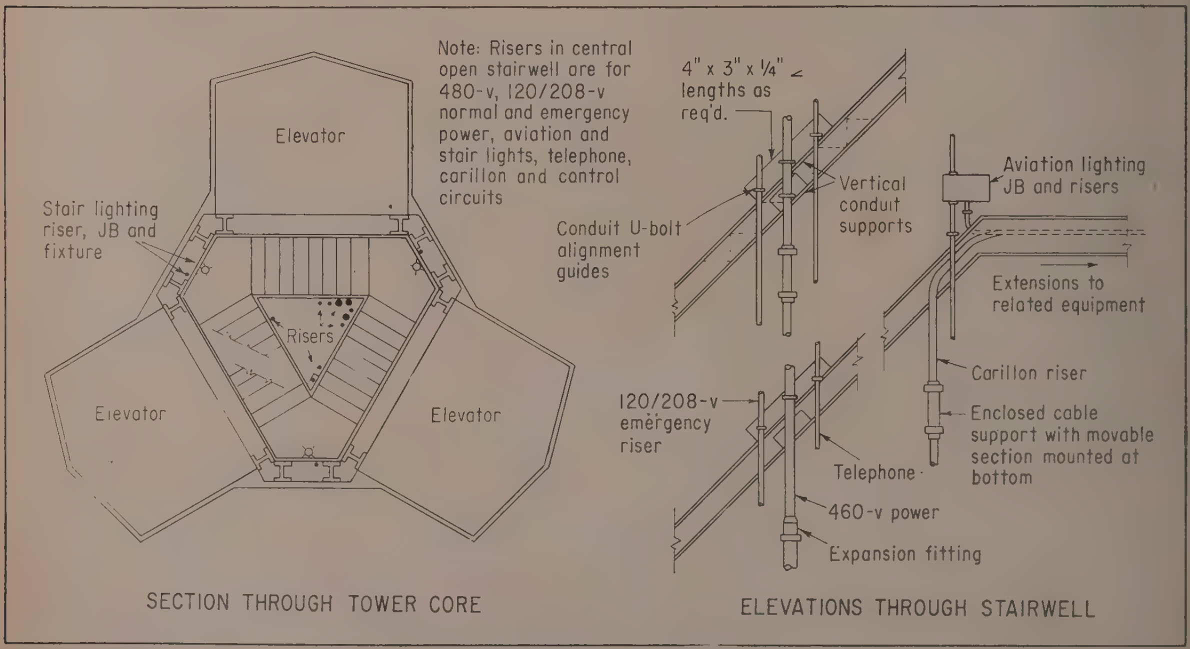
Raceways and apparatus are grounded at many points to an extensive water supply system. Ground rods also are driven beneath each of the six buildings and connected to the electrical system. Copper bus bar grounding circuits are provided around the perimeter of vaults and load center locations to which the apparatus enclosures are securely bonded.

Another permanent structure is the $7½-million Coliseum. Power is supplied at 480/277 volts for lighting, air conditioning compressors, chilled water circulation, exhaust fans and space heating elements. A pair of 300-kva autotransformers steps the voltage down to 120/208 to serve incandescent lighting, two 400-amp plug-in busway systems, plus smaller fans, pumps and heating units. Circuits for 480/277-volt equipment are switched by contactors or motor-operated circuit breakers from activated 120-volt control circuits.

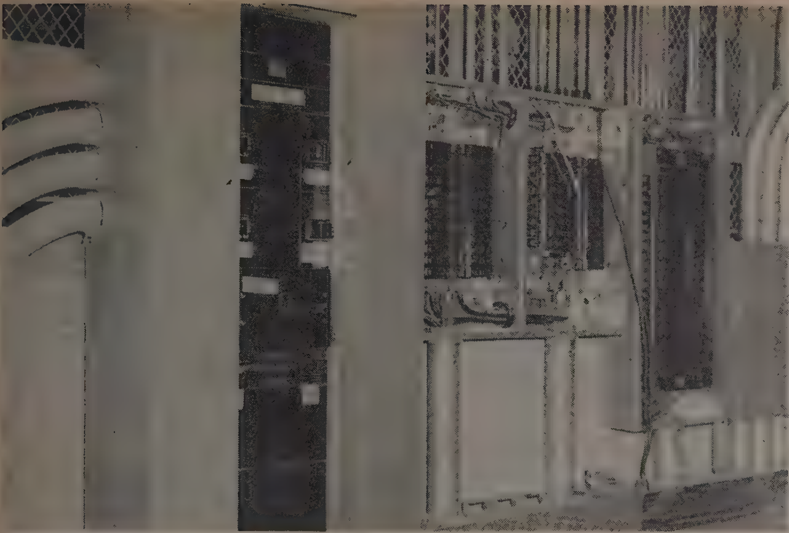
The plug-in busway installations are mounted on the walls of an 8-by 8-ft tunnel encircling and underlying a 4-acre arena floor. They supply power to exhibits. From bus plugs, circuits are extended through tunnel walls to an underfloor duct grid, which serves the central arena. From these ducts, circuits are run in conduit to desired floor locations.

The floor of the arena is topped with compacted sand and blacktop. The underfloor duct system is installed flush with the surface. Thin concrete "knockout panels" are spaced every 20 ft along tunnel walls to simplify wiring connection from busways to the underfloor duct grid. The floor is easily channeled and resurfaced for conduit extensions from the grid to exhibit locations.

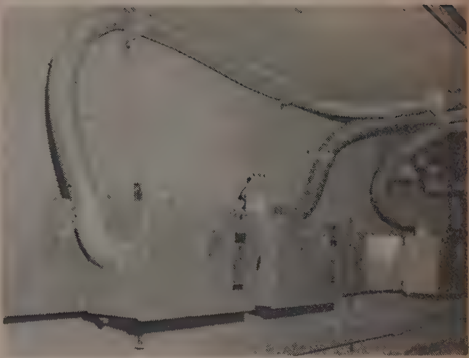
The underfloor ducts are covered with removable 10-gage plates. Power connections to the busways within tunnels are made by circuit-


Note: Risers in central open stairwell are for 480-v, 120/208-v normal and emergency power, aviation and stair lights, telephone, carillon and control circuits
Elevator
Elevator
Elevator
Stair lighting riser, JB and fixture
Risers
4" x 3" x ¼" lengths as req'd.
Vertical conduit supports
Conduit U-bolt alignment guides
Aviation lighting JB and risers
Extensions to related equipment
Carillon riser
Enclosed cable support with movable section mounted at bottom
120/208-v emergency riser
Telephone
460-v power
Expansion fitting
SECTION THROUGH TOWER CORE
ELEVATIONS THROUGH STAIRWELL

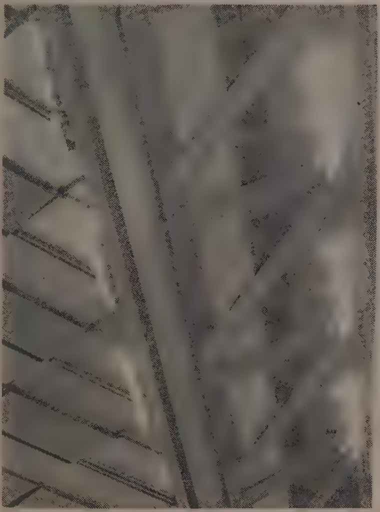
CENTER CORE of tower contains electrical risers. Risers are supported and held in alignment by U-bolt clamps and guides.



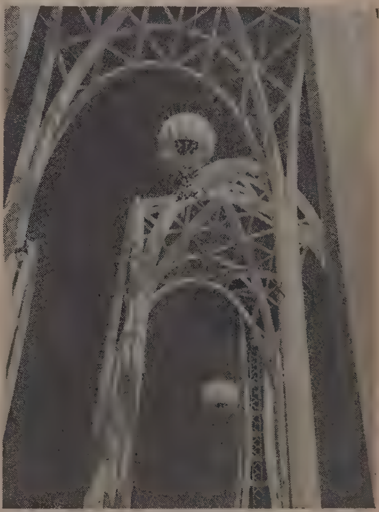
LIGHTING DISTRIBUTION panel obtains service through paralleled 500 MCM cables carried in flexible conduits (left) from dry-type transformer. Note feeders in 6- by 6-in. wireway (lower right) serving centralized exhibit-control panels which are supported by grounded channels extending horizontally for full width of load center.



CIRCUITS TO COLISEUM floor are supplied by circuit-breaker busway plug-in units and extend in conduit to underfloor duct grid.



MERCURY VAPOR floodlights mounted along catwalks of Coliseum are connected through twist-lock receptacles to wiring gutters. Installation includes 272 fixtures variously containing 400- and 1000-watt lamps. In other Fair buildings, light sources include quartz-iodine electroluminescent, xenon, ultra-violet and fluorescent.



TRANSLUCENT SATELLITES, each containing 16 lamps totaling 9.7 kw, are supported by guy wires beneath arches of Science Pavilion. Vacuum-formed methyl methacrylate luminaires enclose floodlights on radial diecast arms. Wiring is in liquid-tight flexible conduits wrapped spirally with copper bonding conductors and jacketed with neoprene.

breaker plug-in units. Flexible conduit connects with rigid conduit prior to piercing walls. Conduits run in the blacktop connect with raised pull and tap boxes.

These boxes are approximately 4 by 12 by 16 in. They are divided to provide ¾ of the space for power circuits and the remaining space for low-voltage wiring.

The arena is lighted by color-corrected mercury vapor lighting fixtures and heated by electric heating units located in the air circulation ducts.

Engineers and Contractors

Building the Fair involved the talents of over a hundred engineers, architects and contractors. Their work was coordinated and supervised by Paul Thiry (who also designed the Coliseum) and Beverly A. Travis (who also engineered the general power distribution system, general lighting, entrance gates, conversion of several major existing structures plus many exhibits and concessions).

Engineers for other major projects included John Graham (Space Needle); Alweg Co. and Sam Hamel (Monorail); Minoru Yamasaki and Assoc., also Naramore, Bain, Brady & Johanson (Science); Batlan & Oxman (Coliseum); Shimizu and Matsushita (theme fountain); plus the Austin Co., Ed Brett, Ras Cook, Robert Grady, the Johnson Co., Morton E. Lerner, Gilbert Mandeville, A. A. Morris, Howard E. Schroedel, Thomas E. Sparling and George Thomalson.

Electrical contracting organizations responsible for major Fair projects included Van S. McKenny (Coliseum and Science); Fischbach & Moore (Needle and Monorail); Atkinson (underground distribution); Anderson (exhibition and banquet halls); Neeco (Opera House and ice arena); Industrial (Food Circus) and Ranier (theme fountain and parking garage). Other electrical contractors included Beacon Hill, Blue Streak, J. Carlson, Close, Cochan, Everglo, Fremont, Grasle, Holert, Lakeside, Langland, Mason, Northwest, Ott-Atwater, Pacific, Pacific-Kent, Seattle, Veca, Warburton, Watts, Reed Wright and others.

Relighting Provides

Ten-Fold Increase In Lighting

Color-corrected mercury lamps in recessed luminaires were used to relight the Collector's Suite of U. S. Custom House, New York City.

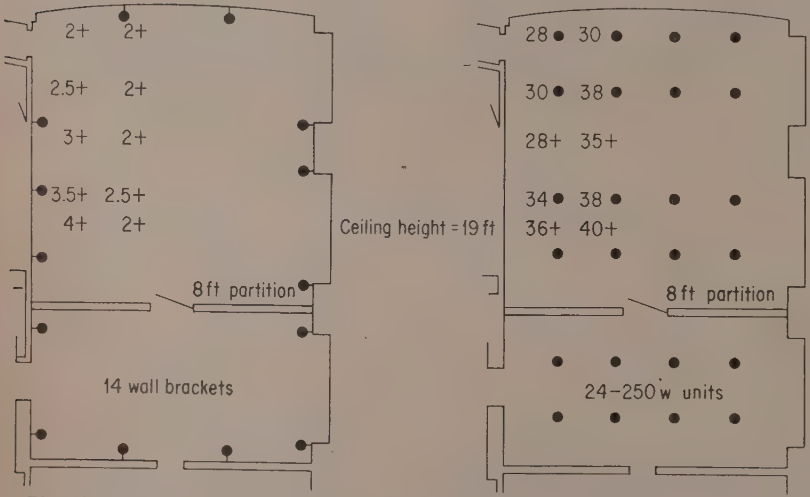
A RECENTLY completed relighting job at the U. S. Custom House in New York City has increased lighting levels in the Collector's office by at least 1000%. The immediate effect has been to reveal, for the first time, this office area in all its true architectural beauty, and to earn the gratitude of the people who work in it.

The occupants of this relighted area supervise the entry of all merchandise into the United States which is routed through the District of New York, as well as the entrance and clearance of vessels which arrive in and depart from the District. Ocean-going ships arrive and depart daily at the average rate of one every 20 minutes, and transport some 46 million tons of freight in and out of the Port annually.

Before relighting this office area, electric lighting was provided solely by wall-mounted bracket luminaires which were installed in 1907 when the building was first occupied. These brackets provided lighting levels in the range of two to four footcandles only, and individual desk lamps were required for all personnel in the area. The Collector's office area comprises a large inner office, divided by a walnut-paneled partition. The total area measures approximately 35 ft wide by 56 ft long. Under the former lighting conditions, the beautiful hand carvings on the inter-office partition could not be distinguished more than a few feet away. Paintings showing ports of the world which were mounted along the upper wall were barely visible, and personnel had the feeling of looking out into the night when they looked up from their desks.

With the new lighting installation, which utilizes 250-watt color-corrected mercury lamps and provides an average of nearly 40 footcandles, the interior appearance is greatly changed. Now, for the first time, the rich traditional grandeur of the room is easily visible and can now be seen and appreciated. The new lighting augments natural daylight which filters in through the windows, and blends well with it.

It had been recognized for several years that the lighting in this area was woefully inadequate. Until recently, however, no serious



FC at desk level with original lighting

FC at desk level with new lighting

COLLECTOR'S OFFICE, U.S. CUSTOM HOUSE, NEW YORK, N.Y.

OLD AND NEW lighting layouts and illumination readings for the Collector's office are shown above. Relighting resulted in an increase of over 1000% in the amount of illumination. The new lighting is fairly uniform throughout the area.

ORIGINAL LIGHTING in Collector's office at the U. S. Custom House, New York City, installed in 1907, consisted of 14 luminous indirect wall-bracket luminaires, which provided about 3 footcandles average on desk tops. As can be seen in this photo, lighting at the desk level was spotty and inadequate.

NEW LIGHTING system provides nearly 40 footcandles of illumination, and consists of 24 new luminaires recessed in the ornate coffered ceiling. Each luminaire uses a 250-watt mercury lamp, in a prismatic glass reflector, shielded by a custom-made louver hinged to a faceplate. Original wall brackets were retained, with low wattage lamps.

effort had been made to improve it. The stumbling block was a fear of damaging the finely coffered ceiling, and otherwise spoiling the architectural features of this building which were designed by the famous architect, Cass Gilbert. The height of the ornamental ceiling is 19 ft, and it was felt that suspended commercial luminaires, such as had been used in relighting several other areas of the Custom House, would be out of keeping with the traditional design of the Collector's office, and spoil its appearance. It was also commonly felt that surface-mounted or recessed commercial luminaires, such as are generally used for office lighting, would not only conflict with the coffered ceiling design, but also not provide the desired amount of illumination.

Because the lighting was so obviously out of date and inadequate, however, the Design and Construction Division of General Services Administration, Region 2, was formally asked to consider this problem, to improve the lighting in the area and at the same time to retain the room's architectural features.

Upon investigation, it was found that the ceiling design consisted of eight transverse rows of large hexagonal troffers, measuring 5 ft 6 in. across, with five coffers to the row. It was also found that small 20-in. square coffers are located at midpoints between the large coffers, consisting of eight rows, four coffers per row. These small square coffers were located on approximately 6-ft 6-in. centers, and it was found that these could be removed, and replaced with specially designed recessed luminaires. Thus, the relighting system could be integrated with the original coffered ceiling without altering its architectural design.

Previous experience of the Government engineers with color-corrected mercury light sources indicated its suitability for use here. A study of ceiling construction showed that adequate space was available for 250-watt mercury luminaires, except that obstructing girders prevented two of the eight rows from being used. Therefore, units were installed in the square coffers in six rows only, four units to a row. This resulted in a lighting layout consisting of three pairs of rows of luminaires, with approximately 13 ft between pairs. Spacing between paired rows is 6 ft 6 in.

Luminaires selected for use were recessed units, consisting of bowl-shaped prismatic glass reflectors 14 in. in diameter, form-fitting metal covers, plaster flanges, metal face plates, and ½-in. cube metal louvers —arranged for use with 250-watt mercury lamps. The metal-louver and faceplate assemblies are custom-made, and designed to prevent glare when looking directly at the units in the normal 45-90° from vertical glare zone. The exposed metal surfaces are finished to match the color of the ceiling, and a most comfortable lighted appearance results.

Six wall switches are used to control the 24 recessed luminaires, with each switch controlling four lights in one pair of rows. The two end units in one row of luminaires, and the two middle units in the adjoining row of luminaires, are connected to one switch. This arrangement gives a balanced illumination, and provides for lighting flexibility.

Ballasts are remotely located, in a space above a hall closet nearby the relighted area. This remote location is accessible, and eliminates the possibility of noise from the ballasts in the relighted section. A wireway duct was installed in the floor above the ceiling for carrying the cables which supply power to the ballasts and luminaries.

The new lighting system is believed to be the first color-corrected mercury lamp installation in an office lighting system in New York City. It has greatly improved working and seeing conditions in the Collector's office, and reveals the architectural design and decorative treatment in its true beauty.

Benjamin Electrical Engineering Works, Inc., New York City, supplied and installed the luminaires, and carried out the necessary wiring and electrical construction work which was involved.

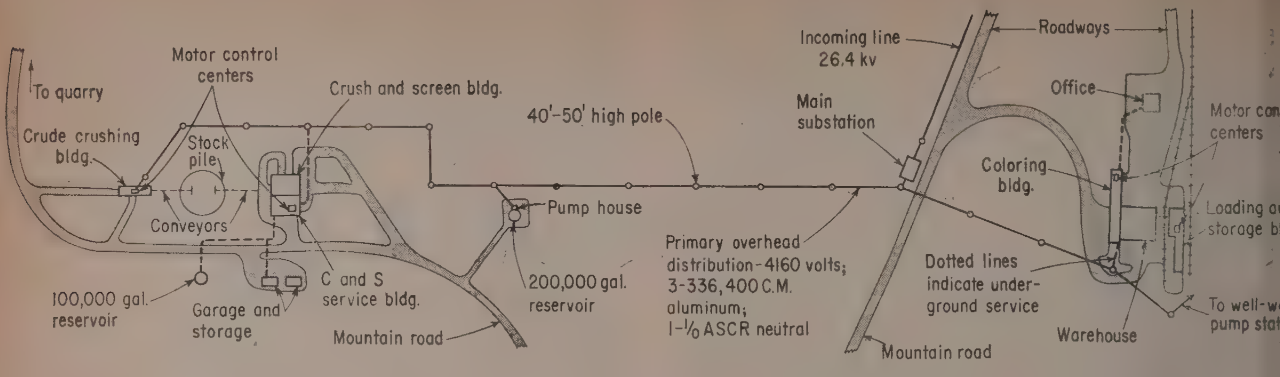


FIG. 1—Plot plan shows overhead primary distribution, roadways and location of motor control centers in major buildings. Distance from the main substation to the C & S service building is nearly one-half mile up a steep grade. Conductors for the 4160-volt primary distribution line include three 336,400 CM bare aluminum cables and one 1/0 ASCR neutral. Primary service conductors from the appropriate pole to major buildings are shielded, 5-kv, with neoprene jacket.

In an Industrial Plant . . .

Packaged Motor Control Centers Cut Costs

Installation, operation and maintenance costs are considerably reduced by modern control centers at Minnesota Mining and Manufacturing Co.'s new roofing granule plant near Belle Mead, N. J. Electrical construction by Schoonover Co. Inc., Mountainside, N. J., included extensive overhead primary distribution to distant buildings.

By Robert J. Lawrie

THE seven major buildings of Minnesota Mining and Manufacturing Co.'s new roofing granule plant, Belle Mead, N. J., present a notable example of sound electrical engineering and expert electrical construction.

Recently completed, the plant requires well over 200 motors plus other electrical equipment to accomplish a grueling rock-crushing process in which roofing granules are produced. Four packaged motor control centers, strategically located, control integrated continuous-process motors and equipment.

Anticipated savings in installation, operation and maintenance prompted the selection of the motor control center system. Although first cost of the control centers was slightly higher than individual motor controllers, over-all installation costs were greatly reduced. This was mainly due to the comparative ease of setting the free-standing control centers and running banks of steel conduit, rather than separate circuits, to motors. On the other hand, if individual motor controllers had been mounted on walls or on framework assembled in the field, and separate motor circuits had been run, installation costs would have been much higher.

Because the manufacture of roofing granules is a continuous integrated process, the motor control center arrangement offered many advantages in operation. Substantial operating savings are realized because groups of motors can be controlled from a central location by a single operator. Thus the number of operators is less, shrinking the payroll. In addition, walking time to and from scattered controllers is reduced making operation more efficient. Further, motor controllers readily can be added or interchanged when necessary.

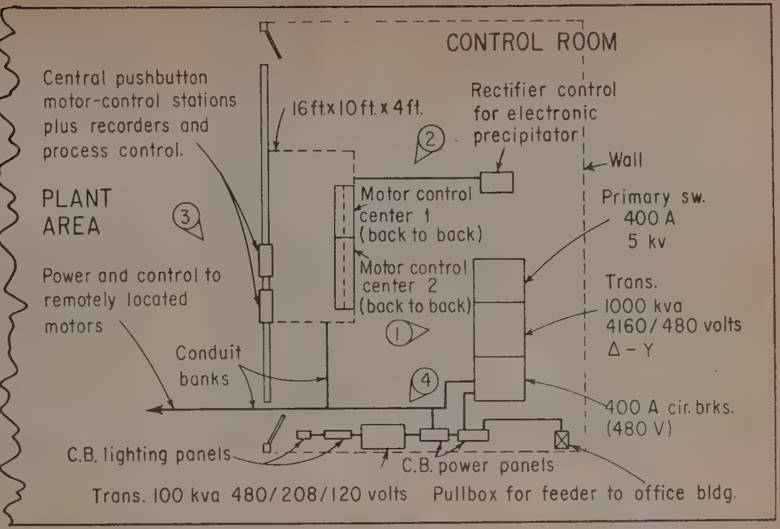

CONTROL ROOM
Central pushbutton motor-control stations plus recorders and process control.
16 ft x 10 ft. x 4 ft.
Rectifier control for electronic precipitator
②
Wall
PLANT AREA
③
Motor control center 1 (back to back)
Primary sw. 400 A 5 kv
Motor control center 2 (back to back)
Power and control to remotely located motors
Trans. 1000 kva 4160/480 volts Δ - Y
①
Conduit banks
④
400 A cir. brks. (480 V)
C.B. lighting panels
C.B. power panels
Trans. 100 kva 480/208/120 volts
Pullbox for feeder to office bldg.

FIG. 2—Motor control centers in coloring building control room are installed back-to-back to conserve valuable space. Giant pull box, mounted over control centers and pushbutton control panels, simplifies installation of hundreds of power and control conductors. Transformer and panel installation shown at bottom of sketch supplies 480-volt power to individual loads and 208/120 volts for lighting and miscellaneous use. Circled numbers with arrowheads indicate angle at which accompaning photos were taken.

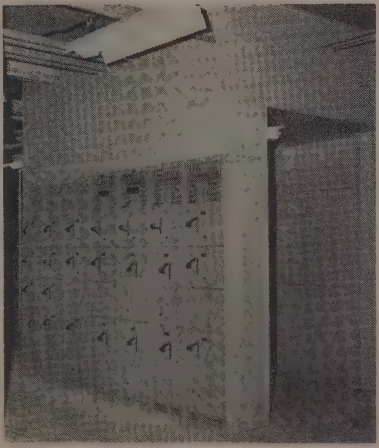


PHOTO 2—Motor control centers for coloring building equipment are NEMA Class 1 Type B. Circuit-breaker handles and overload reset buttons are operable at front covers. Giant pull box, (16 ft by 10 ft by 4 ft) installed over the control center and pushbutton control panel, is constructed of 1½-in. angle iron and 12-gauge steel plate.

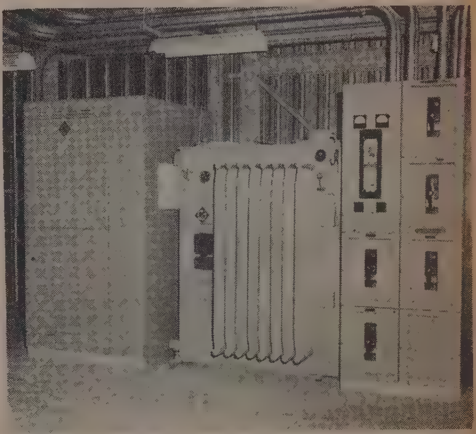


PHOTO 1—Unit substation, located in coloring building control room, is 1000-kva, 4160-volt delta primary, 480/277-volt wye secondary. Primary interrupting switch is rated 400 amps, 5 kv. Transformer is askarel-filled. Low-voltage section of the substation contains 400-amp air circuit breakers and a metering compartment.

Maintenance costs are less since motor controllers are in a single location and easily accessible to maintenance men. This also simplifies associated paperwork and records.

As shown in the plot plan (Fig. 1), the four main control centers are spotted to control motors located in six of the seven major buildings. At the crude crushing building, rocks the size of coconuts are crushed to about ¾-in. aggregate. Conveyors carry the aggregate to a stock pile, then on to the crush and screen building where further crushing produces minute granules for roofing shingles. At the coloring building, the granules are color impregnated and fired in giant kilns. After firing, quality-control tests are completed at a laboratory in the warehouse. Automatic conveyors carry the finished granules through the warehouse to the loading and storage building, where weighing, bagging or loading onto freight cars is accomplished.

In each building, extensive conveyor systems transport granule material between processes. Most conveyors and much of the process equipment are automatically controlled.

NEC Requirements

Size and configuration of the rock-crushing equipment, feeders and conveyors dictated that several of the large processing buildings be nearly 200-ft high. This resulted in motor circuit runs, in many instances, of over 200 ft from the control center. Control of these remotely located motors would be indeed inconvenient, if centralized motor control was not available. This means, however, that the motor is out-of-sight of the controller. And to comply with the NEC concerning out-of-sight motors, all motor control center circuit breakers which serve as disconnecting means, *are capable of being locked in the open position.*

Motors pertaining to building services or to unrelated processes are grouped and controlled from rack-mounted individual controllers or from small control centers.

Motor control centers for the coloring building equipment are located in a 36-ft by 30-ft control room. Also located here are a 1000-kva, 4160 to 480/277-volt, delta-primary wye-secondary unit substation; circuit-breaker power panels; a 100-kva, 480 to 208/120-volt transformer for lighting and miscellaneous power; lighting panels and other process control equipment.

The control centers are NEMA Class 1 Type B. Compartments contain plug-in motor controllers protected by air circuit breakers. Circuit-breaker handles and overload-relay reset buttons are operable at the compartment door. Other compartments contain relays or are available as spaces for future units. Fig. 3 shows a typical physical layout for a motor control center.

In Fig. 2 note that the control centers are mounted back-to-back

PHOTO 3—Pushbutton control panel allows operator to control process equipment and an integrated conveyor system from a single location. Pushbutton station is mounted on ¼-in. steel plate, which forms one wall of the control room. On the control room side, the pushbutton panel control wiring is accessible for repair or maintenance.

PHOTO 4—Power panel at left contains main circuit breakers for the 100-kva transformer and the office building feeder; the next panel supplies 480-volt power to individually controlled motors. The panel to the right of the transformer supplies 208/120 volts to remotely located lighting panels. The small panel at far right controls area lighting.

BANKS OF STEEL CONDUIT emerging from giant pull box extend to remotely located motors. Pull box is mounted over motor control centers which are shown below.

MOTOR CONTROL CENTERS in C & S service building provide control for over 70 motors in an integrated, conveyorized rock-crushing process. Panel standing between the control centers affords control of an electronic precipitator.

thus saving valuable wall space. This is possible because all components are accessible from the front.

Power supply to the control centers comes from two 400-amp, 480-volt circuit breakers which are located at the unit substation. The supply conduits enter a giant pull box (16-ft long, 10-ft wide, 4-ft high) installed over the control centers and pushbutton control panels. Supply conductors connect to incoming line terminals at the top of the control center. Connected to these incoming line terminals, copper bus bars within the motor control center feed the various branch circuit breakers.

From the wireway, a large conduit bank (over 30 conduits ranging from ½ in. to 2½ in.) extends the length of the building with conduits branching off to the various motors.

A single operator controls all process motors from a central pushbutton control panel, which is mounted in the ½-in. steel plate wall between the plant area and the control room. From the control room, the backs of these panels are accessible for repair or maintenance. Control wires from the pushbutton station extend to the motor control centers in a wire basket tray mounted inside the pull box.

Details of this control center and the one in the crush and screen service building are shown in the accompanying photos. Control center construction in other buildings is similar.

Power distribution for the new plant is shown in the one-line diagram (Fig. 4). Because of the relatively great distances between buildings (distance from the main substation to the crush and screen service building is nearly one-half mile), an overhead distribution system was selected.

The utility supplies 26.4 kv overhead to the main substation where a 2500-kva transformer, 3-phase, connected delta-wye, provides the 4160/2400 primary distribution voltage.

From the main substation 600-amp oil circuit breaker, utility poles, 40- to 50-ft high, carry power on three 336,400 CM bare aluminum conductors and one 1/0 ASCR neutral up steep grades and through wooded areas to the various buildings.

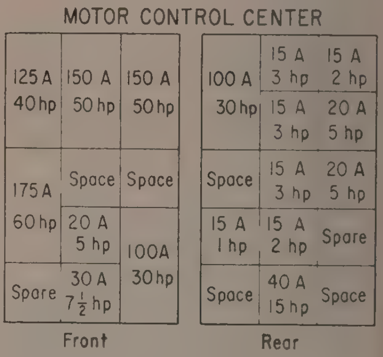


FIG. 3—Motor control center physical layout shows the flexibility of a typical arrangement. Circuit breakers and starters are easily removed or interchanged when necessary.

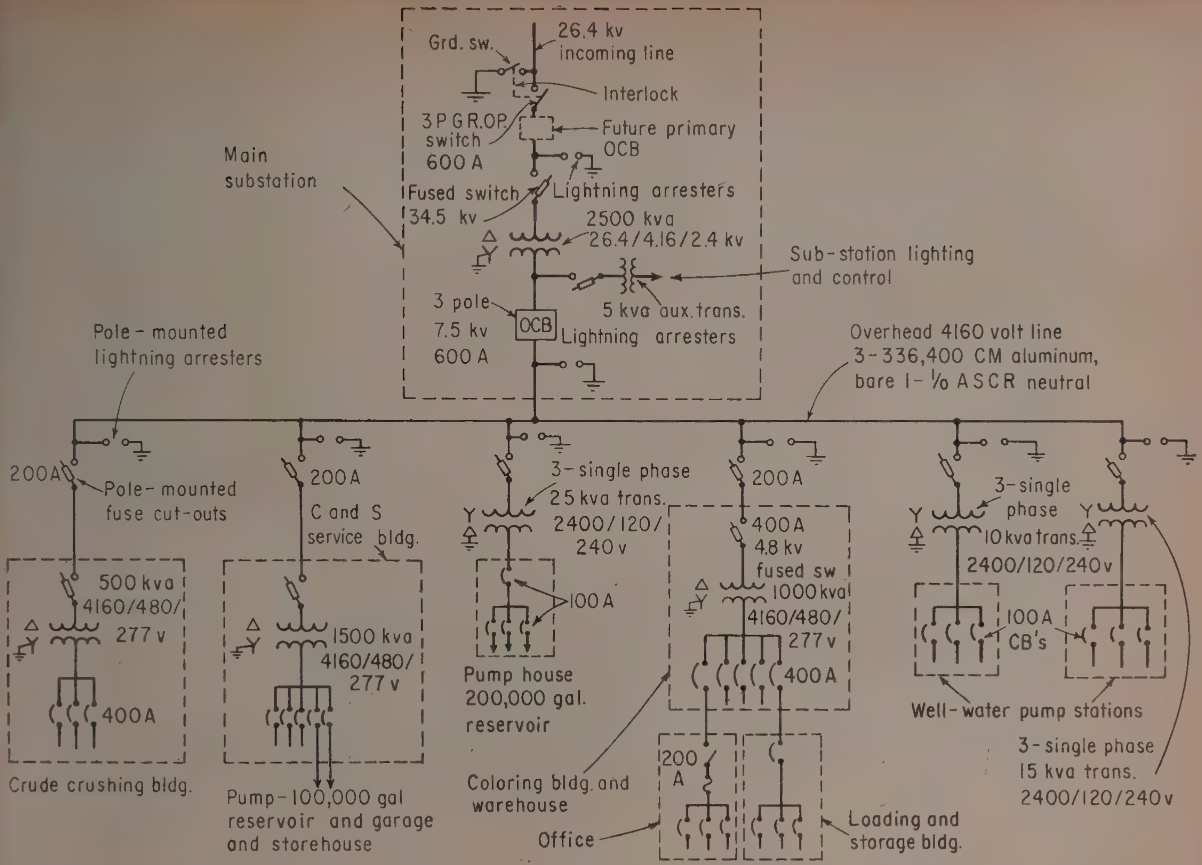
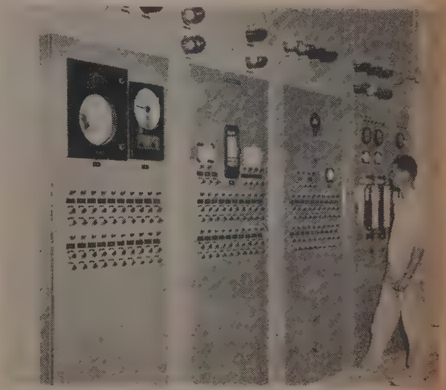

26.4 kv incoming line
Grd. sw.
Interlock
3 P G R.O.P. switch 600 A
Future primary OCB
Main substation
Fused switch 34.5 kv
Lightning arresters
2500 kva 26.4/4.16/2.4 kv
Sub-station lighting and control
5 kva aux. trans.
3 pole 7.5 kv 600 A
OCB
Lightning arresters
Pole-mounted lightning arresters
Overhead 4160 volt line 3-336,400 CM aluminum, bare 1-1/0 ASCR neutral
200A
Pole-mounted fuse cut-outs
500 kva 4160/480/277 v
400A
Crude crushing bldg.
200 A
C and S service bldg.
1500 kva 4160/480/277 v
Pump-100,000 gal reservoir and garage and storehouse
3-single phase 25 kva trans. 2400/120/240 v
100 A
Pump house 200,000 gal. reservoir
Coloring bldg. and warehouse
200 A
400 A 4.8 kv fused sw
1000 kva 4160/480/277 v
400 A
200 A
Office
Loading and storage bldg.
3-single phase 10 kva trans. 2400/120/240 v
100 A CB's
Well-water pump stations
3-single phase 15 kva trans. 2400/120/240 v

FIG. 4—One-line diagram shows power distribution for the multi-building plant. The overhead primary distribution is 4-wire wye with a neutral conductor. Neutral, carried with service conductors, extends to the unit-substation grounding bus to provide a low-resistance ground path. Secondary voltage in major buildings is 480/277 volts, grounded wye. At pumping stations, three single-phase transformers are connected wye-delta to provide 120/240 volts.

At major buildings, feeders are derived from the overhead line going underground at the base of the pole. Power is then carried underground in fiber conduit encased in concrete, through strategically located manholes, to the unit substation within the building. To insure a low-resistance path for phase-to-ground fault currents from the building ground system to the line neutral, the overhead-line fourth conductor is carried in with entrance conductors and connected to primary conduits and to the building ground system.

At outlying pumping stations, the primary voltage is stepped-down to the utilization voltage by pole-mounted transformers and carried overhead to pump house distribution panels. Pole-mounted transformer banks consist of three single-phase transformers connected wye-delta with one secondary phase center tapped. This provides, from the primary phase voltage of 2400 volts, a secondary voltage of 120/240 for pump motors and unit heaters.

COMBINATION MOTOR STARTERS, mounted on a free-standing rack, control a group of pump motors not related to continuous processing. Channel-iron rack is easily assembled in field. Wire trough (6 in. by 6 in.) simplifies conductor installation.



FINGERTIP CONTROL of the continuous-process motors is possible at the push-button control panel in the crush and screen building. Panels are provided with temperature recorders which control temperature in the kilns. Recording wattmeters are also provided.

Pole-mounted fuse cutouts protect each distribution feeder. And to protect against lightning-induced voltage surges, pole-mounted lightning arresters are installed.

The poles also carry telephone lines and telemetering conductors for reservoir water-level monitoring.

Engineers and architects were Toltz, King, Duvall, Anderson and Associates Inc., St. Paul, Minn Electrical contractor was Schoonover Co. Inc., Mountainside, N. J.

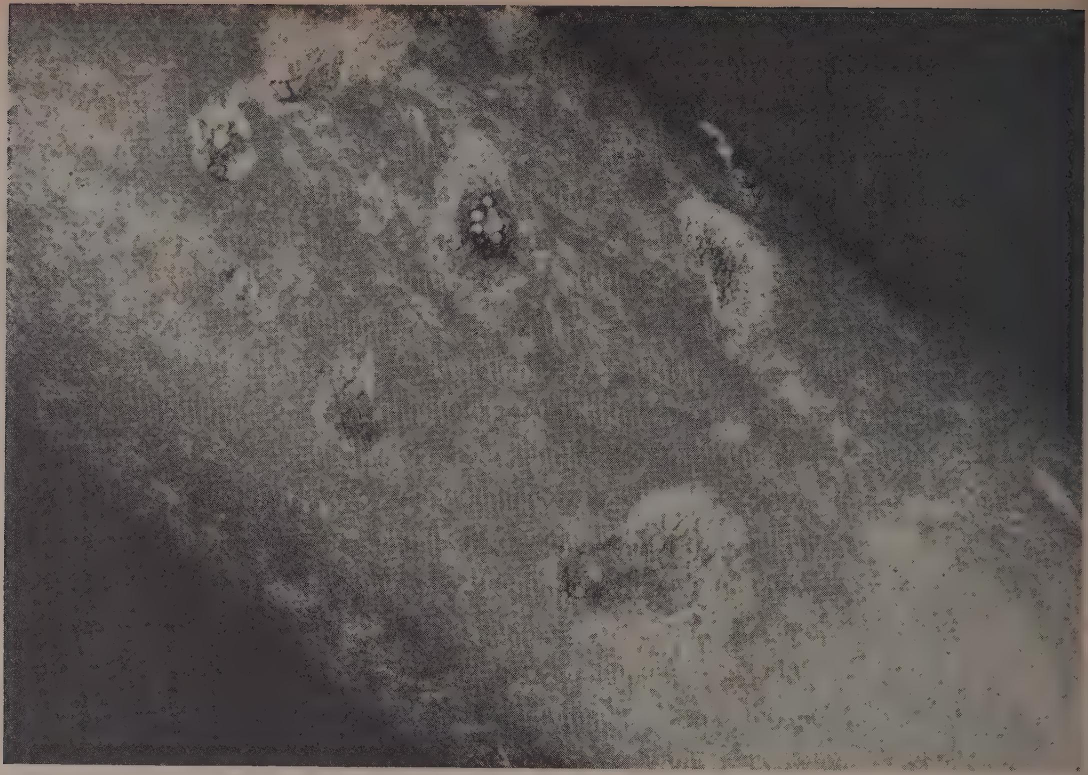


FIG. 1—Termite damage on surface of a rubber or neoprene-sheathed cable.

An underground wiring problem . . .

Insect and Rodent Damage to Cable

A discussion of the problem and treatment of insect and rodent attacks which damage and cause failure of installed electrical cables.

By **H. T. Armitt,** *The Okonite Co.*

THE ever-increasing quantities of cables being used to distribute electrical energy has inevitably brought to the fore problems in maintaining uninterrupted flow of power. Some of these problems are concerned chiefly with the location of the cable installation; that is, they are not related so much to the purely technical considerations of conductors and dielectric materials as they are to the environmental conditions under which they operate underground or overhead in air. Whenever cables are so located they are subject to damage from insects, animals and even birds.

Damage to cable from insect attack is usually confined to beetles, wasps, ants and termites with the latter being by far the chief source of such damage. Animal attack, on the other hand, may come from a variety of species, including mice, rats, squirrels and gophers. For the most part, however, damage to electrical cables may be attributed to two main causes—termites and rodents.

The normal habitat of termites is the woodland where they subsist on dead trees, stumps and fallen branches. The only food of termites is cellulosic material. Termites, therefore, cannot find nourishment in plastics, rubber or rubber-like materials used as insulation or sheaths on electrical cables. When an exploratory tunnel sent out at random by the termite colony encounters a buried cable, the insects may chew on it tentatively in the course of seeking food or merely because it lies in their path and is soft enough to permit them to explore it for possible food.

If wood is present as scrap lumber, partly buried stakes, wooden forms, etc., they will feed on it and when it is exhausted seek additional food in the vicinity and in this way might chew into cables which are buried close to their food supply. The exploratory chewings of the foraging insects on a buried cable may be quite extensive and sometimes penetrate the cable sheath and insulation deeply in one or more places.

The areas on a rubber-covered cable which have been attacked by termites can usually be identified by their appearance under a low power (30x) stereomicroscope. Scratches may be observed around the edges of the irregular surface workings and tunnels, and small yellowish, uniformly shaped excreta spots of these insects can usually be found in the surface depressions of the cable sheath. Fig. 1 illustrates the appearance of termite damage of the surface of a rubber or neoprene-sheathed cable. Typical case histories are as follows:

Case 1. One-conductor, No. 8 AWG, rubber-insulated, neoprene-jacketed cable was buried directly in the soil near a utility station and showed evidence of surface workings and tunnels through the jacket into the rubber insulation. Area has a known history of termites existing in the locality and this sample showed typical appearance of termite damage.

Case 2. Ten-conductor, No. 9 AWG, rubber-insulated, neoprene-jacketed cable installed in asbestos cement. Faults in several conductors disclosed that in one of the manholes the cable was looped across one side of an oak board heavily infested with termites. Cable showed many surface craters and depressions as well as several holes through the neoprene jacket displaying the characteristic appearance of termite attack.

Case 3. Buried, single-conductor, No. 4 AWG, 19x, rubber-insulated cable, with $\frac{3}{64}$ in. jacket of PVC, failed after approximately two years of service. Samples returned for examination showed typical appearance of termite attack with many pits and depressions in surface and several holes in jacket.

Case No. 4. Multi-conductor, No. 16 AWG cable with PVC insulation and sheath, 600-volt type, was installed underground and failed after a short period of service (period not specified). Cable removed and samples returned for examination. Appearance of failure area indicated termite damage and termites were found at the location of cable failure.

Whenever non-metallic covered wire and cable is buried directly in the soil within the normal range of the termite, there is at least some possibility of damage resulting from the activities of these insects. This possibility may be very slight or may be almost certain, depending upon several factors. For instance, cable buried where the ground is moist (but not subjected to flooding) and containing plenty of buried wood would be very much more likely to encounter termite damage than one buried, where there is little, if any, buried wood present and the soil well drained. Moisture is also very important to the termite and in order to maintain a moist atmosphere to protect them from the drying effects of heat and light, the subterranean termite is very apt to use cables as passage ways along which they can excavate a tube or tunnel.

Protecting Against Termites

Since termites live on cellulosic material, one of the most effective procedures in reducing the possibility of such damage is to remove all wood debris (logs, branches, scraps of wood, etc.) from the vicinity of the buried cables. Whenever possible the cables should be laid in well-drained soil. It is also good practice to avoid the use of a buried wood plank as a route marker for buried cable, even if it is creosoted. If a route marker is needed, a gravel or black hard-top path over the back-fill is preferable, not only because it has the advantage of being plainly visible on the surface of the ground but also because such methods are economical and effective. Where mechanical protection is necessary near the cable level, strips of heavy woven galvanized wire fencing or concrete slabs laid on a soft, rock-free fill at least 6 in. above the cable are to be preferred.

In addition to making sure that there is no food for the insects in the form of buried wood, there are various types of insecticides which may be used such as DDT, chlordane and lindane, among others, to discourage termite activity in the soil around a cable installation. Rainfall and ground moisture tend to dilute such insecticides and carry them away; but, in general, they are effective for about a year to two years. Where cables are being installed and the trench is being back-filled, a 2% (by weight) water dispersion of chlordane in a wettable clay may be used as a soil treatment. This may be applied when the trench is about three-quarters back-filled at the rate of one quart per square yard. It should be borne in mind that these materials are toxic to humans as well as to termites. Proper precautions should be taken to avoid inhaling the mist or dust of such preparations or allowing them to remain in contact with the skin.

Perhaps the most effective method for preventing termite damage is to incorporate a hard metallic tape (either flat or corrugated) into the cable construction. Accordingly, a construction involving a 5-mil, longitudinally corrugated, helically wrapped copper or bronze tape which was augmented by a jacket of neoprene, polyvinyl chloride or polyethylene was developed and successfully utilized since the early 1950s. The corrugations in the copper or bronze tape not only increase the mechanical strength of these cables, which is greatly to be desired for direct burial applications, but the corrugations also present a practical means of locking the overlaps and eliminating openings due to buckling which occur with flat tapes, Fig. 2.

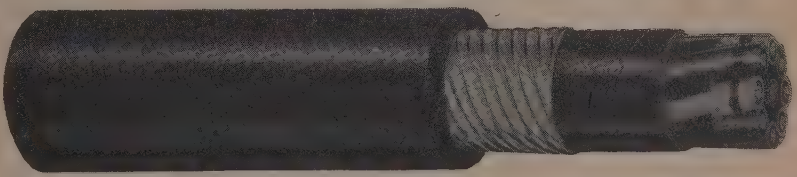


FIG. 2—Termiteproof cable has a 5-mil longitudinally corrugated, helically wrapped copper or bronze tape inside a nonmetallic jacket.

The number of cases of damage to buried cables over the past few years which can be attributed to rodents is considerably less than those caused by insects.

In the populous east where there

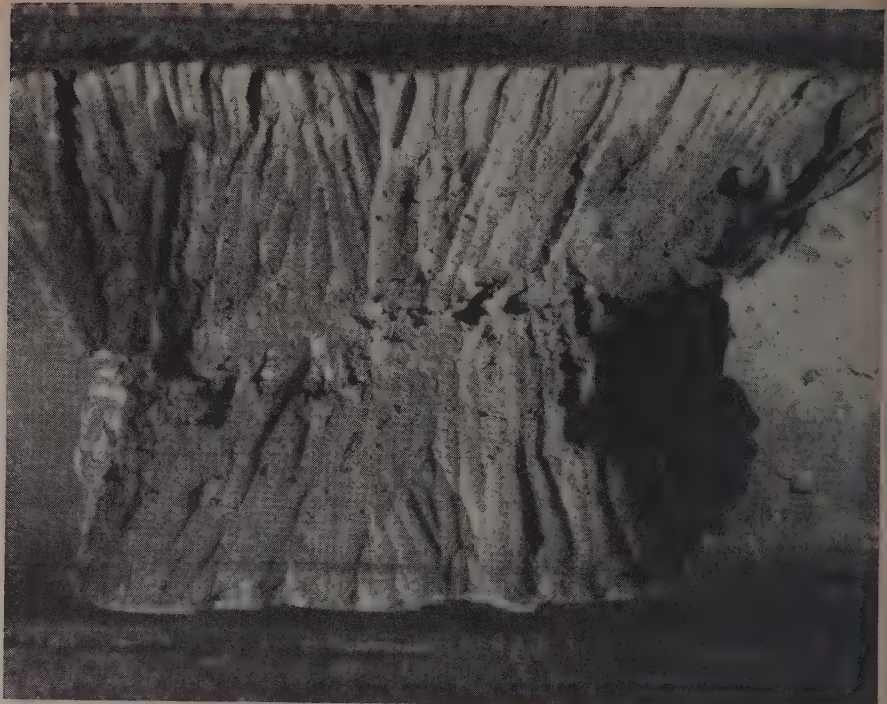


FIG. 3 — An example of rodent damage to a cable covering.

are a great many more industrial and residential complexes covering large areas, the incidence of damage from rats and mice, as might be expected, is greater than in regions west of the Mississippi.

In the western and southern parts of the country the damage to buried cables is caused chiefly by gophers. Although rubber or plastic material such as used in cable manufacture contains no nutrients, rats (and mice also) will sometimes chew on them perhaps to investigate them for possible food or perhaps merely because of an instinctive habit of gnawing on objects of suitable density which they may encounter. In most cases of damage to buried cables caused by gophers, the damage appears to be a by-product of an activity (the instinctive habit of gnawing) not directly related to the search for food. The gnawing, whether done to wear down the incisors or in search of food, may severely damage a rubber or plastic-jacketed cable. In general, rodent damage is readily apparent on the surface of a cable as the incisor teeth make characteristic overlapping grooves in the rubber, usually at right angles to the conductor, Fig. 3. The marks of the teeth may vary somewhat in relative width, depending on the animal that made them. In most cases the geographical area is usually a reliable guide to the species causing the damage.

Following are some typical case histories of rodent damage to various types of cable:

Case 1. 5-kv, self-supporting, rubber-neoprene cable failed due to squirrel gnawing on jacket and insulation. Dead animal found at site of failure.

Case 2. Rubber-insulated, neoprene-jacketed, underground cable installed at airport for runway lighting. Gophers chewed through cable causing outage. Body of gopher found at site of failure.

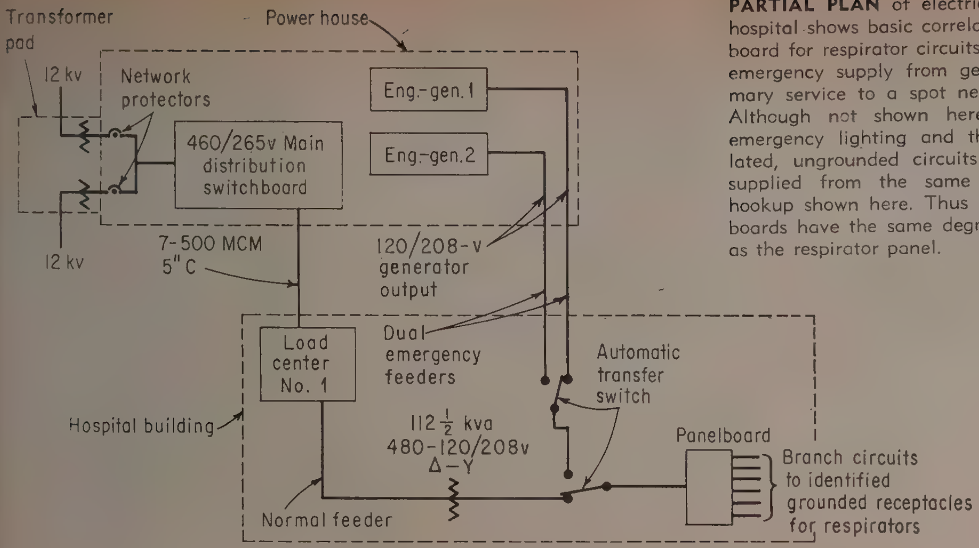
Case 3. Single-conductor, 5-kv, rubber-neoprene cable installed in underground duct in about 1954. Sections containing failure as well as other areas on cable containing teeth marks returned to us for examination. Damage result of chewing by house mouse or possibly rat, based on type of markings on insulation caused by incisor teeth.

Preventing Rodent Damage

In designing a cable which will be gopher-resistant a substantial hard metal barrier is required. Pocket gophers are capable of penetrating all non-metallic and soft metallic kinds of sheathing materials. It has been established, however, that they are unable to penetrate 20- or 30-mil interlocked galvanized steel tape or a 10-mil stainless steel tape. A lead sheath will not serve as an adequate barrier as this metal is too soft.

Gopher activity normally extends to a depth of at least five feet, but most occurs from eight to fifteen inches below the surface. There is some gopher activity at a depth of approximately 30 in. but this in all probability can be attributed to the fact that the soil has been disturbed and loosened in the process of burying the cables, and the animals have simply taken advantage of this situation rather than having shown any preference on their part for a specific depth for their tunneling activities. In any case, a depth of no less than about 3 ft or 36 in. would be recommended for direct burial. This depth will not prevent gopher damage by itself, but it will protect an armored cable from severe and sudden changes in temperature and incidental damage from plowing or other surface disturbances. Flat steel tape armoring will provide the protection against gophers.

There are one or two other measures which may also be taken to reduce the possibilities of rodent damage. First, the cable may be placed in conduit for traversing a limited area which has consistently given trouble from gopher attack. Another measure which would be helpful in all cases would be to make sure that the back-fill is well tamped down. This tends to eliminate an underground path of loosened soil through which the animals might more easily move.


Transformer pad
Power house
12 kv
Network protectors
Eng.-gen. 1
Eng.-gen. 2
460/265v Main distribution switchboard
12 kv
7-500 MCM 5" C
120/208-v generator output
Load center No. 1
Dual emergency feeders
Automatic transfer switch
Hospital building
112½ kva 480-120/208v Δ-Y
Panelboard
Branch circuits to identified grounded receptacles for respirators
Normal feeder

PARTIAL PLAN of electrical distribution for the hospital shows basic correlation of essential panelboard for respirator circuits, normal feeder supply, emergency supply from generators and dual primary service to a spot network for the hospital. Although not shown here, the panelboard for emergency lighting and the panelboard for isolated, ungrounded circuits in surgical areas are supplied from the same normal-and-emergency hookup shown here. Thus these latter two panelboards have the same degree of supply continuity as the respirator panel.

Respiratory-ailment hospital demands . . .

Vital Continuity of Power

. . . for mechanical breathing equipment.

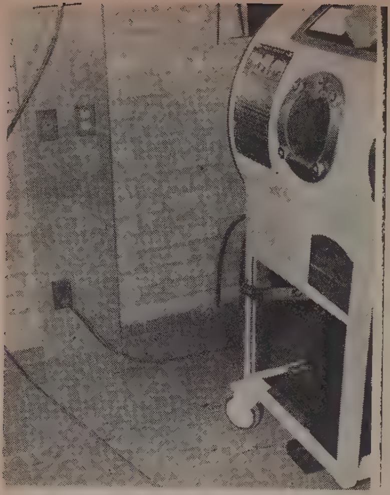
Scope and detail on a maximum-reliability electrical distribution system supplying "iron lungs" and portable respirators for patients in the Texas Institute for Rehabilitation and Research, Houston, Texas. Electrical design was done by John H. Hart, Dale S. Cooper and Associates, consulting engineers, Houston. The system was installed by Hallmark Electric Company, electrical contractors.

By J. F. McPartland

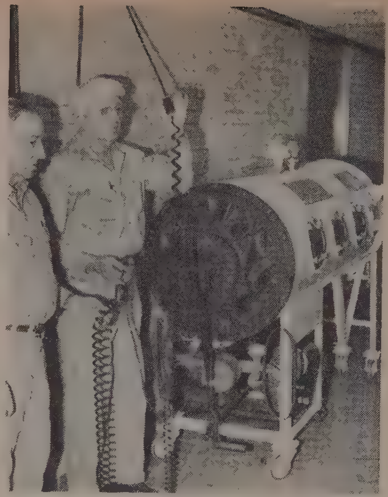
ASSURED continuity of electrical power protects the lives of patients at the Texas Institute for Rehabilitation and Research, Houston, Texas. Here, design and construction of electrical distribution provide reliable energy supply to electrically operated "iron lungs" and portable respirators for patients whose lives depend upon absolutely continuous operation of these mechanical breathing devices. A close look at this system reveals the efficient integration of multiple power sources and flexible utilization outlets for this one-story hospital building.

The tank-type and portable respirators are used throughout the hospital—indoors and out. These are plug-connected motor loads. To provide for ready connection of the plugs at various locations of respirator use, an extensive layout was made throughout the hospital of readily identified receptacle outlets, specially intended for the respirators.

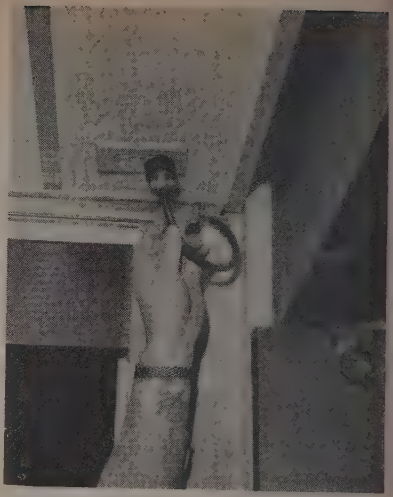
Respirator outlets are 3-pole, grounding type, supplying 120 volts for the loads. Each receptacle plate is painted bright red to identify it as a respirator outlet. Strict en-



IDENTIFIED RECEPTACLE for connection of tank respirator in ward is mounted in face of vertical aluminum cover over chase in wall construction. All receptacles are grounding type to accept 3-wire cord from respirator. All outlets for patients' services—power connection for TV, signal outlet for TV, EKG supervision system outlet—are similarly mounted in a chase cover.

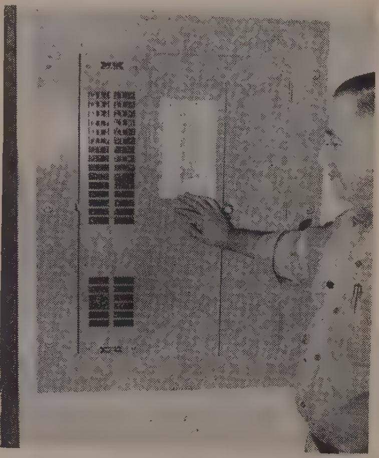


TROLLEY BUSWAY, rated at 20 amps, is installed along ceiling-wall intersection of corridor to provide moving drop-cord connection of respirators in transit. Coiled 3-wire extension cord can reach from trolley drop in corridor to any location in rooms or wards to afford quick transfer of respirator from wall outlet to trolley outlet. Cord plugs and connectors are grounding type.

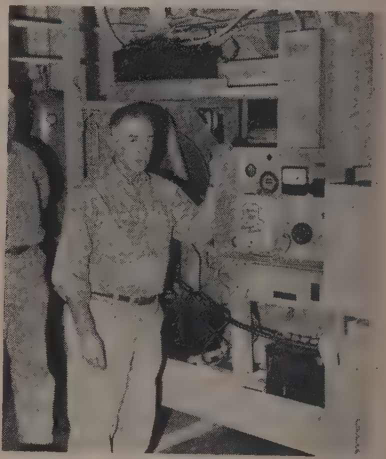


CEILING RECEPTACLE is used as shown to provide power supply to each run of trolley busway along corridor wall. At right, on other side or corridor doorway, plug, ceiling receptacle and another run of busway are installed along corridor.

OUTDOOR RECEPTACLES, wall-mounted in side of building, are single, weatherproof units for ready connection of respirators for patients enjoying sun and fresh air on the patio.



MAXIMUM-CONTINUITY PANELBOARD feeding circuits for respirator outlets, including trolley busway, and other emergency outlets is installed in corridor of main floor, above basement location of automatic transfer switch controlling feeder to panel.



EMERGENCY GENERATORS are installed one above the other on a steel framework in power house. Battery charger shown keeps starting batteries at rated voltage. Output circuit from each generator is carried underground to ATS panel in basement of hospital building.

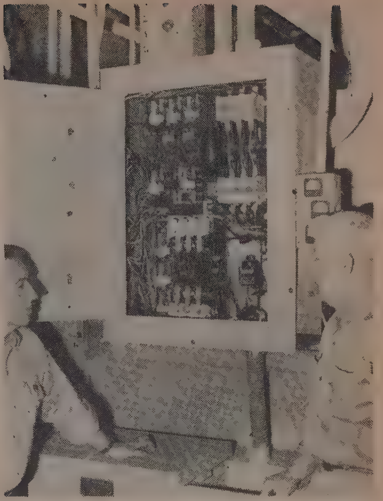
forcement on the use of the outlets prevents their use for any other loads. Outlets are located wherever tank or portable respirators are or might be placed—in wards, private rooms, therapy rooms, dining room, recreation areas, outdoor patio. Some receptacles are wall mounted; others are floor outlets for use where respirators are not near walls. Outdoor receptacles are wall-mounted, weatherproof units.

As shown in accompanying photos, a trolley-busway system is installed in corridors with long, coiled drop-cords to provide supply to tank respirators during movement through hospital. With this arrangement, a tank unit can be disconnected from the wall or floor outlet at one location, immediately connected to a cord from the trolley busway moved to another location and reconnected to a fixed outlet. This can all be accomplished with little or no interruption in breathing action to the patient. Where necessary, manual operation of the breathing equipment can be used to bridge the transfer from one source of electrical power to another.

All respirator receptacles and the corridor trolley busway are fed from a single panelboard on the main floor of the hospital building. This panel contains active single-pole circuits supplying respirator outlets, the trolley busway and certain emergency receptacle outlets.

SIGNAL STATIONS are ceiling mounted at strategic positions in corridors to constantly advise attendants, nurses and other personnel of the condition of power supply to respirator outlets. Under normal conditions, white signal lamp at top is lighted. If normal utility power fails, white light goes out and amber light in middle comes on, warning personnel that transfer to emergency power is in progress and directing them to attend to patients who need absolute continuity of mechanical breathing assistance. The third signal light indicates proper operation of emergency supply.

PORTABLE GENERATOR, the final element of power reliability, is driven by a gasoline engine and has several long trailing cables with duplex receptacle outlets in weatherproof enclosures. This unit can be brought into use if all other power should fail; but it is primarily intended to provide power for respirators outdoors, in the event that the hospital building must be evacuated for any reason (such as fire) and there is no access to other power. The two men shown here and in other pictures are (L-R). John S. Stringer, assistant chief engineer, and John E. Hernandez, chief engineer.



AUTOMATIC TRANSFER SWITCHES and associated signals and controls are mounted in an enclosure in basement of hospital building. Two sets of signal lights on top of cabinet indicate condition of normal power and two generators in power house. One set of signal lights is wired to each generator. ATS assembly at top controls transfer of respirator panel feeder from normal supply to emergency. Relays in circuit sense voltage dip in any leg of supply. A time delay is introduced in load dropout from normal feeder to eliminate effects of lightning and other transients on the transfer, eliminating transfer oscillations with consequent drain on generator starting batteries which are connected on dropout. On genuine phase or line outage of normal supply, speed of pickup of emergency supply is 6 seconds. ATS at bottom of panel provides for transfer from one generator to another if the first one connected fails to start or if any failure—in generator or in emergency feeder circuit from generator—occurs.

Distribution to the panel serving respirator loads is made as shown in illustration. In this layout, continuity of power was the prime objective. As shown, the 120/208-volt feeder to the respirator panel is brought through an automatic transfer switch. This switch, installed in the basement of the building, normally feeds the panel at 120/208 volts derived from the secondary of a transformer bank adjacent to the ATS in the basement. The transformer-bank primary is supplied at 480 volts, 3-phase, 3-wire, brought underground into the hospital building from the main distribution switchboard in the nearby power house which serves all electrical, plumbing and air conditioning facilities of the building.

Emergency Feeders

Two emergency feeders are carried to a second ATS (automatic transfer switch) in the basement. These feeders come from two 18.75-kva engine-generators in the power house. Each of these two engine-generators has a dual-type carburetor to power its engine either with natural gas—the normal fuel supply to the engine—or, if the natural gas supply fails for any reason with gasoline from an underground storage tank buried outside the power house. Each generator has an output of 120/208 volts, 3-phase, 4-wire. The second ATS in the basement provides for selection of either one of the two emergency generators. Operation of the first automatic transfer switch in the basement simultaneously and automatically closes the cranking circuit to the battery source for the particular generator connected to the panel feeder. And if the connected generator does not operate properly, the second automatic transfer switch will transfer the emergency feeder load to the other generator. Thus an extremely high order of power continuity is provided by this hookup.

Still another feature of supply reliability is provided in the service arrangement. The utility has two 12,000-volt supply feeders — each from a separate switching station in the utility primary distribution system. Each 12-kv line feeds a 3-phase transformer in the outdoor pad adjoining the hospital power house. The secondaries of the two transformers are tied together through network protectors, forming a 460Y/265-volt spot network supply to the main distribution switchboard for the hospital. This arrangement provides the continuity advantage of two service feeders. The possibility that both feeders will suffer simultaneous outage is much less than the chance for failure in one feeder.

A final effort in assuring availability of electrical power for respirators is a mobile generating unit kept handy in the power house. This gasoline engine-driven generator is equipped with trailing cords with weatherproof receptacle outlets. This unit is primarily intended to supply respirators in the outside yard of the hospital, where patients would be taken in the event of fire or other hazardous condition in the hospital.

●ESTIMATING FORUM-XXI

How to Allocate Estimating Time—Part II

Hours Per 100 Man-Hours of Job-Labor Method

By **Ray Ashley,** *Research and Consulting Engineer, Oak Park, Ill.*

STATEMENT:

In a previous article we studied the time required for estimating jobs on the basis of hours of estimating time per $1000 of contract base-cost price. We learned that this method has its limitations and weak points.

Now, to establish a more suitable time allocation procedure, let's study a method based on assigning Hours of Estimators' Time per 100 Man-hours of Job-Labor. We could use job labor hours per hour of estimating time, but the above is more in line with the method explored in the previous article.

To my knowledge, the only extensive study made of the cost of electrical estimating was that covered in an article "A Study of Estimating Costs" appearing in the April 1960 issue of *Electrical Construction and Maintenance.* The results of that study will be used here and augmented by a recent study made by Walter Brand, Newbery Electric Corp., Los Angeles.

QUESTIONS:

1. *How many hours (approximate) of estimators' time per 100 man-hours of job labor will be required for:*
   - *a. An annual volume embracing all types of electrical construction?*
   - *b. Large well-engineered projects such as office buildings, hotels, factories?*
   - *c. Alterations—average for large and small?*
   - *d. The more favorable projects?*
2. *What types of buildings have shown the lowest unit of estimating time?*
3. *What objection, if any, is there to this method?*

ANSWERS:

1. *The estimating-time unit (hours per 100 man-hours job labor) for the work in question is as follows:*
   - *a. Annual volume—2.38 hrs.*
   - *b. Large projects—0.69 hrs (use 0.70 for general use)*
   - *c. Alterations—4.42 hrs.*
   - *d. More favorable projects—0.28 hrs.*
2. *Offices and hotels with typical floors show the lowest estimating time unit.*
3. *Prime objection to this method is that it involves extra calculations to determine labor hours.*

DISCUSSION:

In the following discussion any costs attributed to a previous article or study are taken from "A Study of Estimating Costs" noted in the opening statement. When the studies were made, estimators' salaries were, as a rule, low in comparison with then prevailing wages paid to electricians.

To compensate for this condition, approximately 20% is added to the estimating costs used in the following development of estimating units for the categories in question. To avoid any "hair splitting," round figures are used in most cases and are, necessarily, approximations.

Annual Volume

First, we shall establish a unit for an annual volume embracing a variety of construction projects. Studies show the cost of estimating to be 1.04% of the base cost of the job. The adjusted unit is 1.25% (1.04 plus 20%).

The basic data below applies to the example that follows:

The Brand Study of Estimating Time

Project Types	Estimated Job Hrs	Estimating Time Total Hrs	Job Hrs per Estimating Hr	Estimating Hrs per 100 Hrs Job Labor
Office Buildings—10 Story, typical floors (average of two buildings)......	34,626	191	180	0.56
Office Building—1 Story.	8,629	63	137	0.73
Office Building—1 Story.	483	10	49	2.10
Factory—1 Story.......	926	9	109	0.92
Factory & Office Building —1 Story...........	9,873	102	97	1.03
Pole Line—High Voltage.	3,452	77	45	2.22

Data Compiled by: Walter Brand Newbery Electric Corp., Los Angeles, California

Annual Volume of Business...........$800,000
Base Job Cost (75% of volume)....... 600,000
Base Labor Cost (40% of Base Job Cost) 240,000
Mechanics' Wage Rate.............4.00 per hr
Estimators' Pay Rate ($210 per Week) ....5.25 per hr
Cost of Estimating...1.25% of base job cost

The unit of estimating time is determined as follows:

Cost of Estimating (1.25% of $600,000)..$7,500
Hours of Estimating Time ($7,500/5.25) ....1428 hrs (use 1430)
Man-Hours Job Labor ($240,000/4.00) ....60,000 hrs
Job Labor Unit per 100 hrs (60,000/100)....600
Estimating hrs per 100 Labor Hours (1430/600) ....2.38 hrs

Unit of Estimating Time is 2.38 hrs per 100 hrs of estimated job labor.

The Large Project

For large projects, the estimating-time unit is based on the following values taken from "A Study of Estimating Costs":

Projects	Average Cost of Estimating (Percent of Base Cost)
Hospitals	0.48
Hotels	0.27
Office Buildings	0.16
	0.91
Adjustment (add 20%)	0.18
	1.09
Average Cost (1.09/3)	0.36%

For the annual volume category we had an estimating cost of 1.25% of base job cost and an estimating-time unit of 2.38 hrs per 100 hrs of job labor. By proportion, our unit here is: 0.36/1.25 × 2.38, or 0.685 hrs.

Alterations

For large projects use 0.69 hrs per 100 hrs of job labor as the unit of estimating time.

From the studies, the cost (percent of base job cost) of estimating alteration work is as follows:

Small Alterations	3.05%
Large Alterations	0.84%
	3.89
Adjustment (add 20%)............	0.78
	4.67
Average Cost (4.67/2).............	2.33%

Referring back to the annual volume category, we have established an estimating cost of 1.25% of base job cost and an estimating-time unit of 2.38 hrs per 100 hrs of job labor. By proportion, our unit for alteration work is: 2.33/1.25 × 2.38, or 4.42 hrs.

Thus, for alteration work we should assign 4.42 hrs of estimating time per 100 hrs of job labor.

Generally speaking, studies show that large office buildings and hotels with many typical floors have the lowest estimating costs. This is logical since time is spent estimating only one typical floor. The rest is a simple matter of multiplying totals to cover the number of duplicate floors involved.

Objections

One major objection to the method discussed here, is the obvious necessity of figuring the approximate number of man-hours of labor required to install the job. After studying several jobs, one will find this to be a reasonably simple chore. Besides, an estimator who figures job labor man-hours will be more apt to analyze his work more carefully.

Allotting time for estimating electrical projects is an important function of an electrical contracting operation. In an ordinary run of work, an estimator is likely to encounter projects that require anywhere from 0.25 to 2.50 hrs of estimating time for each 100 hrs of job labor. The estimator must know which unit to apply. This definitely is not a job for a novice. Both "A Study of Estimating Costs" and the Walter Brand study in this discussion bear this out.

The unit may be in estimating hours per 100 hrs of job labor, or job labor hours per estimating hour. Both types of units are listed in the Brand study.

Allocating estimators' time on the basis of job labor hours should be a more satisfactory method than the hours per contract dollar method discussed in a previous article. It has a much broader application; can be used for installation-only projects; and will take care of variations in the material-labor ratio.

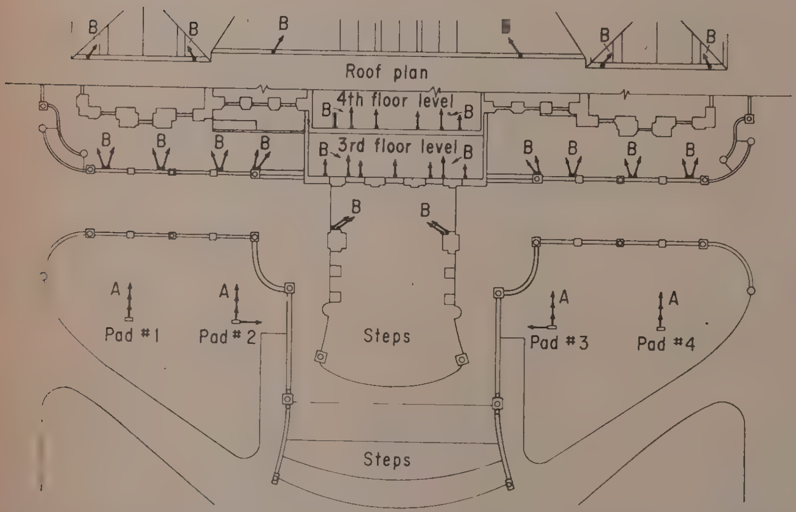
FLOODLIGHTING reveals the majestic beauty of the New York State Capitol building at Albany by night. Floodlighting of the chimneys and the hips of the pyramidal roof at each end of building provides a pleasant contrast to the uniform lighting of the building facade.

Quartz-Lamp Projectors

Floodlight State Capitol

New type of floodlight projectors using quartz-iodine incandescent lamps were used exclusively to floodlight New York's State Capitol building at Albany.

By Donald R. Brown, *Application Engineering Supervisor, Crouse-Hinds Co., Syracuse, N. Y.*

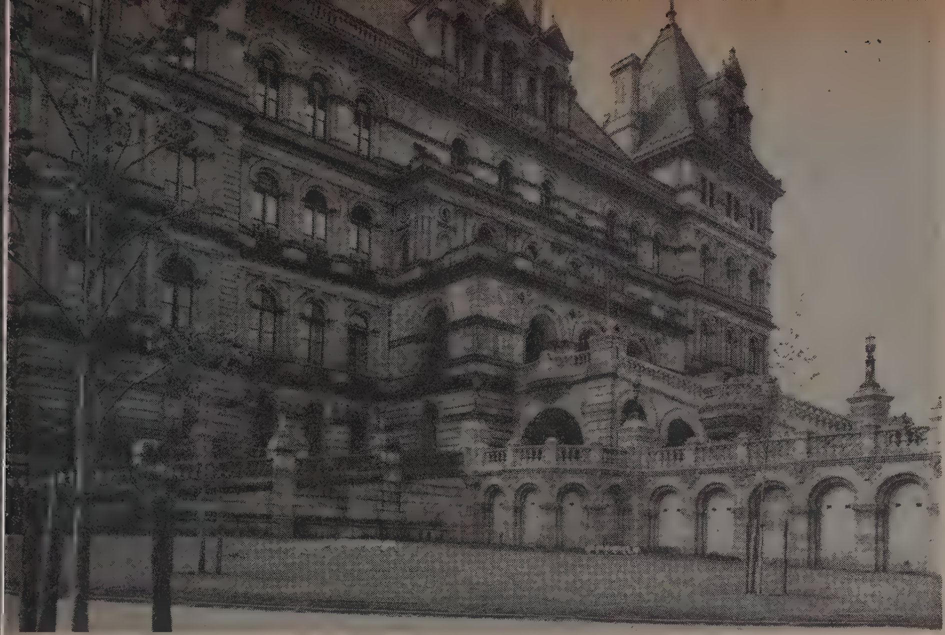


LIGHTING LAYOUT is shown on this plan of steps and balcony setbacks at different floor levels. All "A" units are 1500 watts, and all "B" units are 500 watts. Total lighting load is 53.5 kw, consisting of 20 1500-watt units and 47 500-watt units.

GOVERNOR Nelson E. Rockefeller recently threw the switch which made the New York State Capitol at Albany one of the first buildings in the country to be illuminated entirely by new quartz-iodine type floodlights.

The stately building was thus transformed into a nighttime show place. This is in keeping with the growing trend to illuminate our country's historic buildings and monuments for both the daytime and nighttime tourist and traveler.

A total of 67 floodlights designed specifically for use with quartz-iodine lamps and of varying sizes, were used to illuminate the Capitol. These floodlights and the necessary electrical wiring were installed by H. A. Collman, electrical contractor, Albany, N. Y. Quartz-iodine lamps were selected because of their low



DAYTIME VIEW of building reveals many balconies and an uneven facade. Floodlights located on grounds in front of building each use a 1500-watt quartz-iodine tubular lamp. Floodlights located on building setbacks and ledges are 500-watt units, and well concealed.

initial cost, long life expectancy and high efficiency.

Twenty 1500-watt units were placed on the lawn to bathe the front of the Capitol building.

Another 47 500-watt lamps were placed at various locations on ledges and balconies of the building, to fill in those areas which could not be lighted from the ground.

The accompanying plan shows the exact locations of the floodlights with respect to the building facade, located on the lawn and on the steps serving second, third and fourth floor levels, also on the edge of the Capitol roof.

The quartz-lamp floodlight, which is being used increasingly for a number of different types of floodlighting applications, is an economical type of unit designed specifically for use with quartz-iodine incandescent lamps. This lamp has a 99% efficiency throughout its rated life of 2000 hours. This compares with an 80% average life efficiency and a rated life of 1000 hours for the standard general service incandescent lamp. The quartz-iodine lamp also has a true line source of light (the filament), which makes it possible to control its light output accurately in a beam.

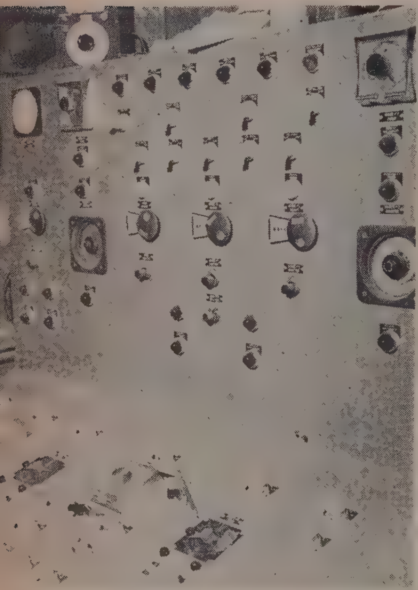
The floodlights used to light the New York State Capitol building are of two sizes, one for 500-watt quartz-iodine lamps, the other for 1500-watt quartz-iodine lamps. Each floodlight consists of a cast-aluminum door and housing, tightly sealed by a silicon rubber gasket, a one-piece die-formed polished aluminum reflector which provides maximum light control and efficiency, a heat- and impact-resistant glass lens, lamp sockets, and a yoke-type mounting and base. These floodlights are specifically designed for locations where a small, highly-efficient floodlight and an accurately-controlled beam of light is desired. As can be noted in the illustrations, these floodlights are small enough so that they can be concealed easily on building ledges and elsewhere.

BANKS of floodlights on building grounds are adjusted by electricians. Located 38 ft out from the first building wall, these 1500-watt floodlights bathe the front of the building in a uniform intensity of illumination.

SMALLER UNITS using 500-watt lamps were installed on balconies and walkways to fill in areas not covered by the 1500-watt units installed on the building grounds in front of the building.

Control Console Operates Field Concrete Plant

An electrically operated, console-controlled concrete plant at Chicago's O'Hare Field enabled Arcole-Midwest Corp. to pour more than 123 acres of jet apron for new terminal buildings at a 4,000 to 5,000 cu yd per day rate.



CONSOLE PANEL with timers, lights, switches and buttons, gives operator finger-tip, centralized control of automatic cement plant. Mike and speaker (upper left) gave him instant contact with radio-equipped trucks and supervisors' cars at construction site.

ELECTRICAL service and equipment played a vital role in the installation of 123 acres of 15-in. thick concrete parking apron and taxiway behind the two new passenger terminal buildings at Chicago's O'Hare International Airport. Jet airliners taxi over this apron to reach more than 60 gate positions of the three passenger concourses. Two of these are Y-shaped "fingers" extending from each of the 770-ft long terminals. The third is a straight "finger" extending from the base of the shallow V formed by the two buildings.

To meet a rigid construction schedule, Arcole-Midwest Corporation, Skokie, Ill., used a "portable" Rex automatic concrete plant erected at the field within sight of the construction area. The term "portable" is used in the sense that the entire plant, including electrical equipment and facilities, can be dismantled and relocated at another site when desired. Circuits to the various motors were of the "plug-in" heavy-duty cable type. Electrical service and initial wiring were installed by Hyre Electric Company, Chicago electrical contracting firm.

Timed in Seconds

Concrete production time at the field plant was clocked in "seconds." Although designed for maximum output of 710 cu yds per hour, Arcole-Midwest operated the twin-mixer plant at a 550 cu yd per hour rate. Automatic weighing, batching, feed, and console control permitted continuous operation on split-second scheduling.

Electric controls and timers were set for an 8 cu yd batch with a 90-second mixing time (including charging) and a 10-second discharge of the batch into a waiting agitator truck. The two mixers operated in an alternate pattern—one discharging while the other was mixing. Thus, with two lines of waiting trucks, an 8 cu yd load of concrete left the plant about every 100 seconds for the comparatively short haul averaging less than a mile to the apron site.

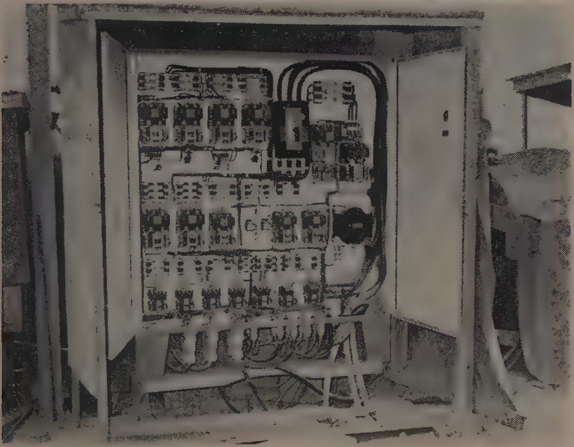
Console Control

Nerve center of the electrical system, and plant operation, was a console panel with its array of timers, dials, pilot lights, switches and buttons. Key to achievement and maintenance of the production schedule was a single operator in the control booth. At his fingertips were selection of mixer, timing of mixer operation and discharge, control of automatic batching, charging conveyor, vertical and horizontal screws, water pumps, and other accessory equipment. Continuous flow of predetermined quantities of sand, cement, stone and water from storage facilities to mixers was his responsibility. And two-way radio gave him immediate contact with the radio-equipped trucks and supervisors' cars at the apron site.

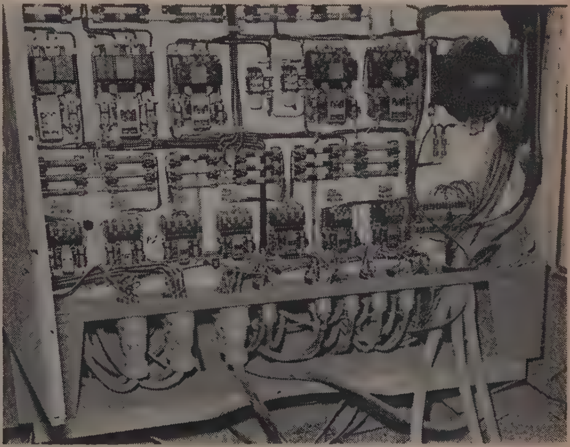
Fully automatic weighing of materials was accomplished by dial-a-weight controls with a recycle feature. The charging cycle of the

TWIN-MIXER PLANT at O'Hare field. Tilted mixer discharges batch while drum at right churns. Automatic plant is controlled by console panel in booth (arrow) under main charge conveyor. Cement silos are in background; water tank in foreground.

AGGREGATE BIN is fed by three belt conveyors from storage piles (one sand, two stone); discharges weighed batch quantities to deep-trough charge conveyor underneath. Operator at top keeps bin loaded.



DISTRIBUTION PANEL under console houses main service breaker, overcurrent protection and magnetic switches for branch motor circuits. Voltage for power is 480; for control, 110. Panel can be quickly disconnected and relocated.



PLUG-IN CIRCUITS to motors originate at receptacles in bottom of main panel. Heavy conductors at right come from temporary outdoor transformer mat. Transformer in panel provides 110 volts for control circuits.

mixers was controlled by automatic sequence selectors which operated to preblend the materials entering the mixers. These were cycled so no time was lost by the use of belt charging. And the charging chute to the mixers was automatically interlocked with the mixer controls.

Electrical Features

Approximately 500 horsepower in various sized motors was required to operate the plant. The 750-bbl cement silos had a motor-driven integral screw system for filling and batching. Cement and water were batched overhead (water metered to a holding tank), and the aggregate was carried from the aggregate bins to the mixer chute by a 48-in. deep-troughed belt conveyor with a 60-hp motor drive. This conveyor could charge 8½ cu yds of aggregate in 18 seconds.

Each 8½ cu yd capacity mixer was driven by two 40-hp motors and was tilted by a 30-hp hydraulic pack. Other motors ranged up to 25 hp size.

Directly under the control booth was the main electrical panel containing the main circuit breaker, overcurrent protection for the motor branch circuits and magnetic switches for console control. A series of receptacles at the panel base accommodated the plug-in, heavy-duty flexible cable circuits.

The 4160-volt, 3-phase primary service terminated at a temporary outdoor transformer mat where three 150-kva, single-phase transformers provided the 480-volt, 3-phase secondary power. A control transformer in the main distribution panel provided 110 volts for the console control circuits.

New apartment building features . .

Selective Feeders and Emergency Lighting

Two 11.8-kv primary services, each from separate utility substations, provide a high degree of system reliability for a modern apartment building. And for maximum safety, a battery-operated, emergency lighting system operates automatically if normal power fails.

WIDELY publicized, massive power failures in several major cities during 1961 dramatized the essential role electrical power plays in today's buildings. As a result of these power failures, building tenants quickly learned the crippling effects of loss of power. But on the plus side, these experiences aroused the imagination of building owners and consulting electrical engineers, who, in planning new buildings, saw the need for more reliable service facilities. Such was the case in the new Plaza Apartment Building located in Wilmington, Del.

Fifteen stories high, the Plaza, built and operated by Ernest Di Sabatino and Sons, contains a total of 237 units, ranging from one-room to five-bedroom suites.

Two separate primary feeders, rated at 11.8 kv, feed from separate substations of the Delaware Power and Light Co. Each separate primary feeder, consisting of three, single-conductor 15-kv cables in a 4-in., concrete-encased underground conduit, terminates in separate, 3-pole 15-kv load interrupter switches. A spare 4-in. conduit is available for future use.

To insure that only one feeder can supply power to the building at one time, the two 15-kv load interrupter switches are interlocked. From the tie on the load side of the switches, a single feeder runs to a transformer bank of three 333-kva single-phase units where the voltage is reduced to 208Y/120 volts. The transformer secondaries extend to a 3000-amp, electrically operated CB, which constitutes the main disconnect for the distribution switchboard.

In the event one primary feeder fails, the second primary interrupter switch is closed after opening the switch for the faulty feeder. This assures full power to handle the entire electrical load of the building. Since the two primary feeders are supplied from different utility systems, it is unlikely that both feeders would fail at the same time. However, massive power failures can occur, which could leave an entire community in darkness. And in such instances, normal evacuation from a building is difficult without confusion or possible panic.

Should both primary feeders serving the Plaza fail, or during the time it takes to transfer loads

INCOMING POWER for the Plaza Apartment is supplied at 11.8 kv through either of two primary feeders. Two interlocked, 3-pole 15-kv load interrupter switches insure that only one feeder can supply the building at one time. The 1000-kva transformer bank supplies the building switchboard.

EMERGENCY POWER is provided by 20 interconnected 3-cell battery units near the main switchboard. If normal power fails, the 120-volt battery network automatically illuminates 30 emergency lights in each of two stairwells and 32 hallway lights (two in each of 16 halls).

from one primary feeder to another, a complete emergency power system operates automatically and provides sufficient illumination in hallways and stairwells. This allows tenants to leave the building without difficulty.

Power for the emergency lighting system is furnished by storage batteries with a capacity of 41.3 amps (100 amp-hr at the 8-hr rate of discharge) providing 115-volt 4750 rated lamp watts for 1½ hours to 105 volts.

Upon interruption of the ac supply, an automatic transfer switch instantly cuts on battery power to designated emergency lights. The battery, which can carry a 5100-watt load for 1½ hours, illuminates 30 emergency lights in each of the two stairwells and 32 hallway lights (two in each of 16 halls). All such fixtures contain 60-watt lamps.

Consisting of 20 interconnected 3-cell units in transparent plastic jars, the battery system is conveniently mounted on a three-tier steel rack in the basement. The battery is maintained at a full rate by a charger capable of providing a 6-amp high-rate charge. And the battery charger has a trickle rate of 0.8 amps.

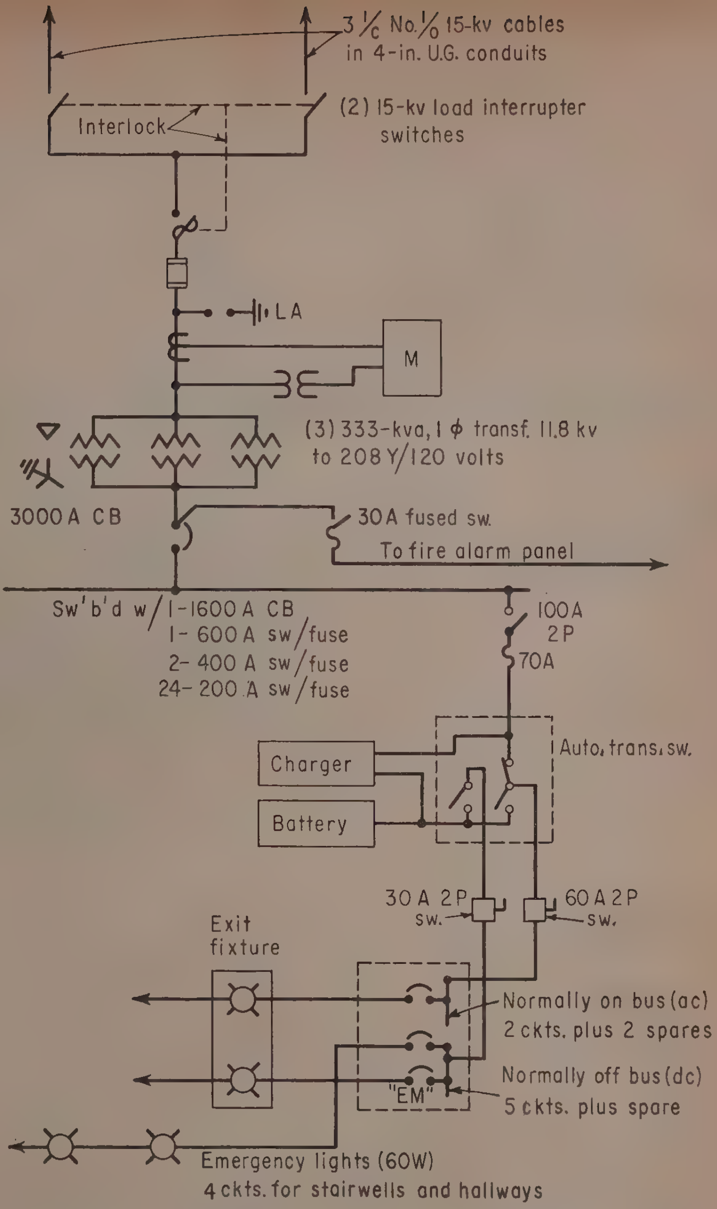
After restoration of normal power, the charger automatically recharges the battery at the high rate, preparing it in the shortest possible time for the next emergency. Battery-maintenance requirements are minimal. Building custodians check state of charge and water levels once a month.

While the selective feeder and emergency lighting systems for the Plaza are unique, there are several other noteworthy features. For example, the building's fire alarm system includes two alarm boxes in stair corridors on each floor and three gongs on each floor. And each apartment is equipped with combination heating and air conditioning controls, which regulate the overall temperature.

Lobby, basement, stairwells, hallways and elevators are completely air conditioned.

In each apartment, all-electric kitchens include a wall oven, cook top, dishwasher, waste disposer and combination refrigerator-freezer.

The entire electrical installation was made by the Light and Power Construction Company of Wilmington. Consulting engineers were E. J. Ewald and E. H. Miller of Philadelphia.



TWO PRIMARY FEEDERS provide two separate supply sources to 1000-kva transformer bank serving 234-unit apartment building. Selective primary switching permits transferring load to another feeder should normal power fail. Each primary feeder is tied to different utility substations. Backstopping the dual-feeder system is a central battery network.

LOBBY LIGHTING combines recessed and extended fixtures to achieve attractive decor. The 15-story apartment building has complete air conditioning, including the lobby, basement, stairwells and hallways. Apartment units have all-electric kitchens.

In Wadena, Minn. . . . . .

Extra-Heavy Insulation Pays Its Way

Analysis of an electrically heated home's submetered energy during first winter of operation shows total net return of up to 29% on extra first-cost investment with 10 in. of blown cellulose insulation in ceiling, 5⅝ in. in walls, and 7 in. in floor.

By **Glydewell Burdick,** *Wisconsin Power & Light Co., Madison, Wis.*

CAREFULLY reported data on the construction and electric heating of a model home with extra-heavy insulation near Wadena, Minn., make possible a detailed analysis to show the economic advantages of the extra insulation.

The home was erected in the summer of 1960 by the Todd-Wadena Electric Co-operative, Wadena, for the specific purpose of obtaining accurate information on construction and operating costs. Departures from standard construction include 2-by-6 studding on 16-in. centers, permitting 5⅝ in. of wall insulation; an average of 10 in. of insulation in the ceiling and 7 in. in the floor; and triple glass in all windows. All insulation is blown cellulose; floor area within outside walls is 1549 sq ft.

Wadena is about 150 miles northwest of the Twin Cities and has an 8500-degree-day climate with a −20F outside design temperature. The coldest temperature reached during the 1960-1961 winter was −30F, occurring on Jan. 24, accompanied by a 15-mph wind. Temperatures of −20F or colder were reported on eight days of the winter.

Heating energy, submetered during the period of Nov. 16, 1960 to May 15, 1961, was 10,747 kwhr. Degree-days for the period were 7011, as shown in Table 1. Expanding this figure to a full year of 8500 degree-days gives 13,028 kwhr and a $228 annual heating cost at the prevailing energy price of 1.75¢ per kwhr, or 14.7¢ per sq ft.

The heat factor during the metered period was thus

$$\frac{10{,}747\ \text{kwhr}}{7.011\ \text{MDD} \times 1549\ \text{sq ft}} \text{ or } 0.99\ \text{kwhr/sq ft/1000 DD.}$$

In Table 2 the details of the extra first costs are shown, with the extra insulation labor allocated to ceiling, floor and walls in proportion to the cost of the insulation. This data is needed to analyze separately the effects of the ceiling, floor and walls on over-all cost.

Cost Analysis

To calculate with reasonable accuracy the savings in operating cost produced by the use of extra-heavy insulation, a better energy-use formula than those usually employed is necessary. Also, the calculation of design heat loss should be consistent with the energy formula used.

To accomplish this, it was assumed that the house was situated in Madison, Wis., rather than in Wadena, and new heat-loss calculations were made as described in Chart 1. This was done because (1) official weather data for degree-days to the 70F base

CHART 1. Effect of Extra Insulation on Heat Loss and Annual Energy

FRESH AIR
100 cfm
Btuh — 9200
Kwhr — 6422

DOORS
56 sq ft
U — 0.31
Btuh — 1475
Kwhr — 968

WINDOWS
203 sq ft
U — 0.41
Btuh — 7080
Kwhr — 4644

CEILING		INSULATION 6-4-2	10-6-7
1549	U	.0453	.0252
sq ft	Btuh	5970	3320
	Kwhr	3916	2178

WALLS		6-4-2	10-6-7
1249	U	.0594	.042
sq ft	Btuh	6300	4460
	Kwhr	4133	2925

FLOOR		6-4-2	10-6-7
1549	U	.0894	.034
sq ft	Btuh	3345	1550
	Kwhr	4680	2165

TOTAL HOUSE		INSULATION 6-4-2	10-6-7
1549 sq ft	**Design Heat Loss**		
floor area	Btuh	33370	27085
	Btuh/sq ft	21.5	17.5
	Watts	9777	7936
	Watts/sq ft	6.31	5.12
	Annual Energy		
	Kwhr	16616	11155
	Kwhr/sq ft/MDD	1.449	0.973

DESIGN CONSTANTS	
Outdoor design temp.	−15F
Indoor design temp.	70F
Degree-days (base 65)	7405
Degree-days (base 70)	8435
Computed heat gains (kwhr)	8147

The heat-loss values shown in Chart 1 have been recalculated from the basic data supplied by the Todd-Wadena Electric Co-operative, using U-values corrected for the effect of the wall, floor and ceiling framing, and the 85-degree design temperature difference (70F inside, -15F outside) of Madison, Wis.

Original calculations for a 90-deg TD and one air-change per hr resulted in a total design heat loss of 39,519 Btuh. Reducing this to ½ air-change brings the figure down to 29,507 at a 90-deg TD; multiplying by 85/90 gives 27,868 Btuh. This compares closely with the 27,085 Btuh given in Chart 1.

Annual gross energy requirement was estimated by multiplying the design Btuh heat loss by a "climate factor," converting the Btuh to watts and introducing the degree-days:

$$\text{Climate factor} = \frac{.293\,\frac{\text{watt}}{\text{Btuh}} \times 24\,\frac{\text{hr}}{\text{day}} \times 8435\text{ DD} \times 0.94}{85\text{ deg TD}} = 0.656$$

This is a refinement of the degree-day method of estimating energy, in which the degree-days are calculated to the 70-deg base, the heat gains being credited separately. The factor 0.94 corrects for the prevalent wind speed, which is less than the 15-mph design wind speed assumed in the heat-loss factors. For a complete discussion of the method, see "Problems in Estimating Electric Heating Costs," *Electrical Construction and Maintenance*, August, 1959; and "Design Heat Losses and Annual Energy Requirements," EHF No. 1, July, 1960.

The seasonal energy consumption due to ceiling heat loss with 10-in. of insulation is thus estimated to be

$$3320\text{ Btuh} \times 0.656 = 2178\text{ kwhr.}$$

Energy attributed to window, door and wall losses is calculated in the same way. Energy used due to infiltrating fresh air, however, is based on an assumed ½-air-change per hour; hence the 0.94 is omitted, giving a multiplying factor of 0.698:

$$9200\text{ Btuh} \times 0.698 = 6422\text{ kwhr.}$$

The climate factor is not applicable to the floor heat loss, since floor loss is not proportional to degree-days. Temperature differences used in calculating the design floor losses shown were 29.4F for 7 in. of insulation and 24.1F for 2 in.; the seasonal average temperature differences used were 21.4F and 17.6F respectively. Details of determining these temperature differences are given in "Calculating Floor Losses," *Electrical Construction and Maintenance*, January, 1960.

The window, door, and fresh air energy consumption was assumed to be the same under both conditions of insulation.

is readily available for Madison; (2) data for ground temperatures at Madison is available; and (3) the economic analysis will be useful over a wider area if based on the 7405 degree-day climate of Madison than if based on the more severe 8500 degree-day climate of Wadena. *The insulation that pays its way in the milder climate obviously will more than pay its way in more severe climates.*

The annual energy was then estimated as indicated in Chart 1, giving a heat factor of

$$\frac{11{,}155 \text{ kwhr}}{7.405 \text{ MDD} \times 1549 \text{ sq ft}} \text{ or } 0.973 \text{ kwhr/sq ft/MDD}$$

for the heavily insulated condition. This is so close to the actual experience heat factor of 0.99 that it supports the energy estimating formula and the ½ air change per hr as being reasonably correct.

Design heat loss and annual energy were then calculated for the same house but with the more conventional "6-4-2" insulation of the same quality (6-in. ceiling, 3⅝-in. walls, 2-in. floor), using the same energy estimating formula. The over-all estimated saving by the use of the heavier insulation is thus the difference between 16,610 and 11,155 kwhr, or 5,461 kwhr.

The significance of this saving is shown in Table 3. At an energy price of 2¢ per kwhr, this represents an annual saving of $109.22, accomplished at an additional first-cost of $372.28 (Table 2). The life of a house should be at least 40 years. This additional investment in the house will recover for the homeowner his extra first-cost, while paying him a *tax-free* return of about 29% per year! And surely he has protected the resale value of his house: with a record of low annual operating cost, the house is worth a lot more than with a $109-per-year higher operating cost. (An investment return of 6%—one-fourth of the return for this insulation investment—is considered respectable, and income taxes take part of that 6%.)

TABLE 1. Degree-Days, 1960-1961

Wadena, Minn.

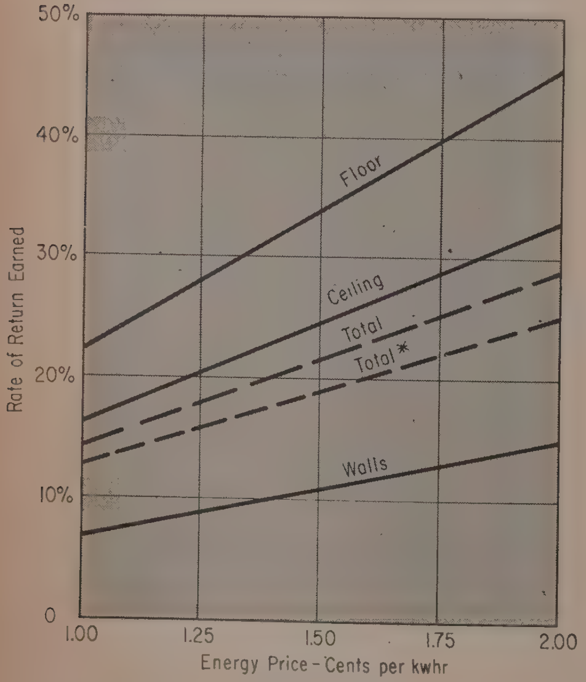
As Reported by Weather Bureau		Estimate for Metered Period	
November	1020	November 16–30	526
December	1601	December	1601
January	1732	January	1732
February	1189	February	1189
March	942	March	942
April	850	April	850
May	372	May 1–15	171
Total	7706	Total	7011

Looking at it another way, the extra first-cost is recovered in the first 3½ years, and thereafter the homeowner has a saving of $109 a year clear.

The 2-by-6 Wall

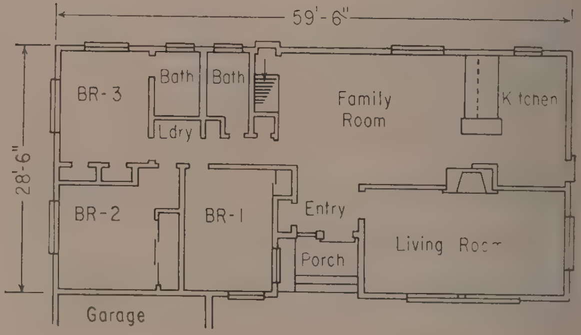
Table 3 breaks down this saving to show the contributions of the separate parts—the walls, ceiling and floors. The thicker wall insulation, with its extra structural cost, is the most questionable item. It is resisted by many people simply as a matter of habit or custom. Does it actually pay its way?

CHART 2. Rates of Return on the Extra Investment for Various Energy Prices



*Lower dashed line shows total rate of return assuming no savings in initial equipment.

Construction Details



Walls:	Dry wall interior 5⅝ in. blown cellulose insulation (R-23); 2 x 6 studs 16 in. on center 25/32 in. insulating board sheathing Wood siding
Ceiling:	Dry wall interior 10 in. blown cellulose insulation (R-41)
Floor:	Wood floor & subfloor over unheated basement 7 in. blown cellulose insulation (R-29)
Storm sash:	Triple glass throughout.

Table 2 shows the following total extra first-cost of the walls:

Insulation	$43.50
Structure	133.24
Total	$176.74
Saving in wiring and equipment	16.20
Net extra cost	$160.54

Table 3 shows that the 6-in. wall is saving 1208 kwhr or $24.16 a year. The saving will recover the $160.54 first-cost while paying 15% a year on the investment.

As indicated in Chart 2, the rate of return on the investment decreases as the energy cost decreases. However, it will be noted that the use of 2-by-6 walls does not become marginal until the energy is something less than 1¢ per kwhr. At 1½¢ or more, the saving is very much worth while.

Chart 2 includes a dashed line representing the total investment return if the $30 per kw in initial wiring and equipment is not considered. It may be argued that the saving in heating capacity due to the reduction in heat loss in theoretical and will not necessarily be attained in practice, depending upon the method of sizing heaters, the type of equipment used, and the chance of commercially available sizes being a good match for the heat loss. However, for the same reasons, the saving will be double the $30 per kw in other cases. This is a matter of chance, and for the purpose of analysis it is realistic to use a moderate figure rather than to ignore the item. It is obvious from Chart 2 that whether or not such a saving is realized has only a small effect on the results.

Conclusions

To sell more electric space heating, we need more proof in the form of actual experience figures that homes can be heated economically. The Wadena home is one more example. The economy indicated, *plus* substantial air-conditioning savings, which have not been included in the above calculations, *plus* the considerably greater degree of comfort due to warmer walls and greater thermal inertia—these are invaluable tools that can and should be used in sales efforts designed to show that suitable homes can be heated electrically at a reasonable cost, even in cold climates.

TABLE 2. How Much Does It Cost To Provide the Extra Insulation?

Figures show extra first costs of 10–5⅝–7 insulation as compared with 6–3⅝–2 insulation at the Madison, Wis., retail price level.

	Material	Labor	Total
Insulation			
Ceiling	$105.30	$20.80	$126.10
Floor	103.95	20.80	124.75
Wall	35.10	8.40	43.50
Total	**$244.35**	**$50.00**	**$294.35**
Structural			
2 x 6 (instead of 2 x 4) walls	$58.24	......	......
Window & door extensions	50.00		
Total	**$108.24**	**$25.00***	**$133.24**
Gross extra cost	**$352.59**	**$75.00**	**$427.59**
Savings in wiring and equipment**			**$55.31**
Net extra cost			**$372.28**

* $25 extra has been allowed for the 2 x 6 and window labor, although the carpenter on the job said, "It was really no more of a problem" than standard wall and window framing.

**Extra insulation reduced heat loss by 1841 watts, or 6285 Btuh. Savings in initial equipment and wiring were calculated at $30 per kw, or $.0088 per Btuh.

TABLE 3. Rates of Return on Extra Investment In Heavy Insulation

Earned by Savings in Yearly Operating Cost

	10 in. instead of 6 in. in ceiling	5⅝ in. instead of 3⅝ in. in walls	7 in. instead of 2 in. in floor	Total
Annual Kilowatt-hours				
6–3⅝–2 insulation	3916	4133	4680	12729
10–5⅝–7 insulation	2178	2925	2165	7268
Saving	1738	1208	2515	5461
Annual Cost Saving @ 2 cents per kwhr	$34.76	$24.16	$50.30	$109.22
Heating Capacity, Btuh				
6–3⅝–2 insulation	5970	6300	3345	15615
10–5⅝–7 insulation	3320	4460	1550	9330
Reduction	2650	1840	1795	6285
Saving in First-Cost of Equipment @ $.0088 per Btuh	$23.32	$16.20	$15.79	$55.31
Extra First-Cost, Insulation & Structure	$126.10	$176.74	$124.75	$427.59
Saving in Heating Capacity	23.32	16.20	15.79	55.31
Net Extra First Cost	$102.78	$160.54	$108.96	$372.28
Capital Recovery Factor (Ratio of "Annual Cost Saving" to "Net Extra First Cost")	0.338	0.150	0.462	0.293
Rates of Return being earned on the extra investment (from interest tables)	33%	15%	46%	29%

Power Plan for Mass Merchandising

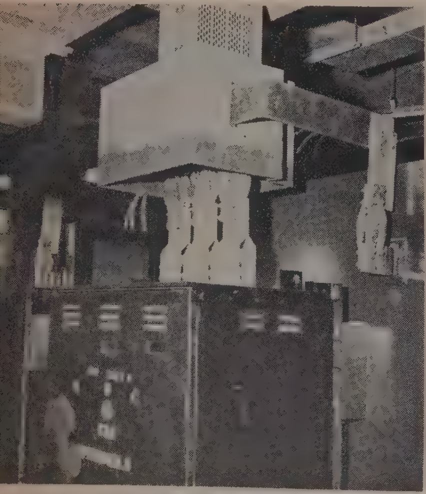
New 7-acre department store in Oregon has 900-amp distribution center, two alternate emergency power sources, control centers contained within moving-stair wells and numerous variations in underfloor duct details, raceway support and lighting treatments. Electrical work was by W. R. Grasle of Portland; design was by engineer-architect John Graham of Seattle.

A NEW metropolitan business-shopping center, recently completed in Portland, Ore., covers 56 city blocks. Its 14 buildings offer over 1¼-million sq ft of rentable floor space. The project requires the services of about 5,000 employees who work for more than a hundred separate tenants varying in size from small specialty shops to large mercantile establishments.

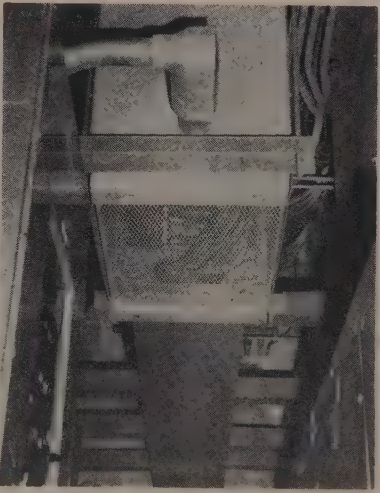
The complex provides an 8,000-car parking facility, numerous restaurants, complete air conditioning and a skating rink with seating provisions for 2,200 spectators.

Mass movement of shoppers is facilitated indoors by oversized moving stairways and elevators, while exterior passage from one building to another is through connecting covered walkways, balconies and wide malls flanked by landscaping.

Due to the size of the project, the work was let in four major contracts. Ten electrical sub-contractors were employed to wire the buildings, to install street and parking lighting, to provide a basic primary underground system for seven transformer substations, and to extend a network of busway feeders to local distribution centers in tenant premises (see "Mile Long Bus Complex," *Electrical Construction and Maintenance*, October 1960).



VIBRATION TRANSMISSION between transformer secondaries and feeder busway is reduced by flexible copper-ribbon connectors installed between network switches and busbar terminals. Soft rubber gaskets dampen vibrations between components and perforated-metal protective connector enclosures, (temporarily removed to show connections).



SECONDARY TRANSFORMER in upper-floor electric room is suspended above central aisle by trapeze angles, rod hangers and expansion anchors in overhead slab. Expanded metal bottom grille permits air circulation. Note oversized gutter carrying secondary wiring to square raceways, then down to wall-mounted panelboards.

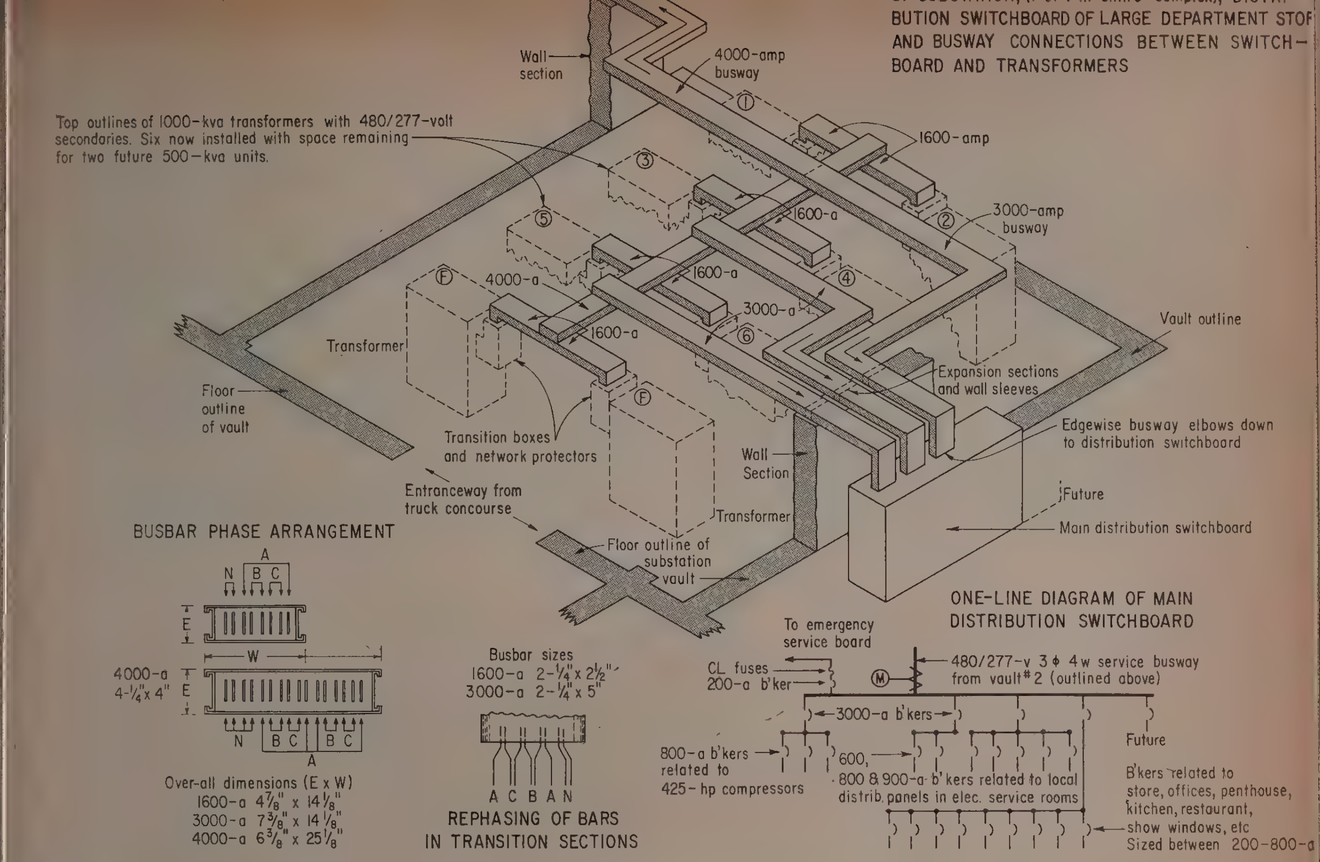
An idea of the electrical construction involved can be gained by examining features in just one of the structures, a 5-level 300,000-sq-ft department store occupied by Meier & Frank. This building, together with the skating rink and three additional structural units, were wired by W. R. Grasle, electrical contractor.

Power is brought to the building at 480/277 volts from one of the seven project substations. There are six 1000-kva transformers within a vault delivering secondary power through transition sections and network protectors to a central overhead busway arbor, then via three 3000-amp, 3-phase, 4-bar (full neutral) busway takeoffs through a common wall into Meier & Frank's main switching center, then through edgewise busway elbows and additional transition sections down to the main distribution switchboard.

Capped busway extensions and floorspaces for two additional 500-kva transformers are provided. Additional capacity will be installed in the near future when the present structure is heightened by several additional floors.

9000-Amp Switchboard

Within the free-standing, dead-front, metalclad switchboard, a 9000-amp bus structure serves five 3000-amp feeder breakers. A connection is also made to an adjacent emergency service panelboard through current-limiting fuses and a 200-amp breaker.


BUTION SWITCHBOARD OF LARGE DEPARTMENT STOF
AND BUSWAY CONNECTIONS BETWEEN SWITCH-
BOARD AND TRANSFORMERS
Wall section
4000-amp busway
Top outlines of 1000-kva transformers with 480/277-volt secondaries. Six now installed with space remaining for two future 500-kva units.
1600-amp
①
③
⑤
1600-a
3000-amp busway
②
Ⓕ
4000-a
1600-a
④
3000-a
⑥
1600-a
Transformer
Vault outline
Expansion sections and wall sleeves
Floor outline of vault
Transition boxes and network protectors
Ⓕ
Wall Section
Edgewise busway elbows down to distribution switchboard
Future
Entranceway from truck concourse
Transformer
Main distribution switchboard
BUSBAR PHASE ARRANGEMENT
A
N B C
E
W
4000-a 4-¼" x 4"
E
N B C B C
A
Over-all dimensions (E x W)
1600-a 4⅞" x 14⅛"
3000-a 7⅜" x 14⅛"
4000-a 6⅜" x 25⅛"
Floor outline of substation vault
Busbar sizes
1600-a 2-¼" x 2½"
3000-a 2-¼" x 5"
A C B A N
REPHASING OF BARS IN TRANSITION SECTIONS
ONE-LINE DIAGRAM OF MAIN DISTRIBUTION SWITCHBOARD
To emergency service board
CL fuses
200-a b'ker
M
480/277-v 3 ϕ 4w service busway from vault # 2 (outlined above)
3000-a b'kers
Future
800-a b'kers related to 425-hp compressors
600, 800 & 900-a b'kers related to local distrib. panels in elec. service rooms
B'kers related to store, offices, penthouse, kitchen, restaurant, show windows, etc Sized between 200-800-a

ISOMETRIC SKETCH shows configuration of busway structure connecting transformer secondaries with central arbor and main distribution switchboard serving department store. This substation (one of seven serving giant Lloyd Center) presently contains six 1000-kva units plus capped busway extensions and floorspace for two additional 500-kva units.

Switchboard air circuit breakers are roll-out units designed to prevent breakers from being closed if movable components are not in alignment. Positions of manually operated breakers are indicated by targets. Each 3000-amp breaker feeds a separate bus structure serving smaller breakers for air conditioning compressors, kitchen and restaurant load centers, floor distribution rooms, motor control centers, show windows and executive office panels.

Any interruption of normal service, as for example a fault in Vault No. 2, would activate one of two automatic transfer switches, connecting elevator motors and all emergency panelboard circuits with an alternate utility power source (coming from Vault No. 1 located in an adjacent building). However, Vault No. 1 provides 120/208-volt secondary service while Vault No. 2 delivers current at 480/277 volts. A transformer provides the necessary cross connection.

Should this emergency source of utility power also fail, a second automatic switch would transfer critical emergency loads to a 165-kw diesel generator.

Central Electric Rooms

The electric control room on each upper floor is centered within the motor stairway well. Fourteen sets of AVL 4-wire feeders extend underground from the main distribution switchboard in the basement to riser shafts, serving the control rooms above. Each 4-in. riser contains three 500 MCMs and a 2/0 neutral.

Electric rooms are 5 by 22 ft. Risers and pullboxes, distribution and control panels, relay and ballast compartments are racked along opposite walls. Dry-type low-noise-level transformers are suspended from the ceiling by anchor bolts. Secondary power between the transformers and their 120/208-volt distribution panels is carried first through an oversized overhead trunk wireway then through square raceway branches containing telescopic sections.

In addition to motor control panels located in centralized floor electric rooms, local panelboards and motor control centers handle areas such as kitchens, restaurants and beauty parlors, functions such as air conditioning, pumps and fans and services such as elevators and show windows.

In general, motors rated at or below ½ hp are single-phase units operating at 120 volts, with thermal overload protection mounted externally in easily accessible locations. Larger motors are 3-phase 480-volt units with magnetic starters.

Underfloor Raceway Variations

In general office and merchandising areas where floor outlets are numerous and located along straight lines, underfloor ducts are installed with uniformly spaced collars and outlets, junction boxes, intermediate connection ducts, saddle supports and marker screws.

Normally this would have been a routine procedure involving slightly over 2000 outlets.

MERCHANDISE on wall racks and counters is illuminated by double rows of fluorescent lamps placed end-to-end behind valances; sections spanning doorways leading to fitting rooms or service areas have louvering or plastic diffusing shields.

LANDSCAPED promenades and covered balconies connect stores. Exterior areas are well lighted, enhanced by background music, fountain displays and attractive landscaping.

In this instance, however, the installation was complicated by the fact that the store interior was redesigned after initial duct work had been completed. One of the changes involved the installation of terrazzo as a floor covering, rather than vinyl as originally planned. The change raised the elevations of finished floors and demanded inserts of varying heights.

The electrical contractor solved this latter problem by cutting standard conduit couplings in half to obtain insert extensions. These extensions then were secured to collars by means of threaded nipples. This solution also permitted adjustment for height.

In addition to outlets located along underfloor duct runs, many other power outlets had to be installed for placement of tenant furniture or equipment.

These outlets are floor boxes cut into the slab and connected by conduits run beneath the slab. Holes were cut with diamond-core drills.

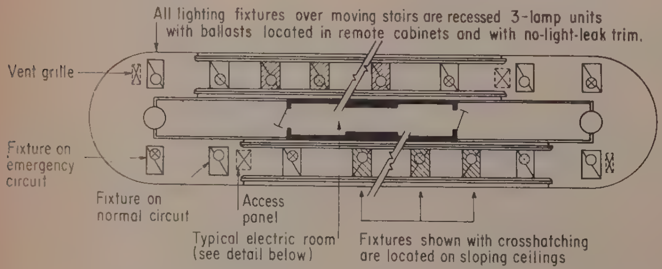
Due to numerous structural variations within this building, conduits are supported by a variety of methods including inserts and hangers, pipe straps, toggle bolts and lag screws.

Rigid conduit connections at outlet and junction boxes and cabinets are made with double locknuts and insulated bushings. EMT connections are made with compression fittings except when tubing contains only telephone circuits. In such instances indented types are used.

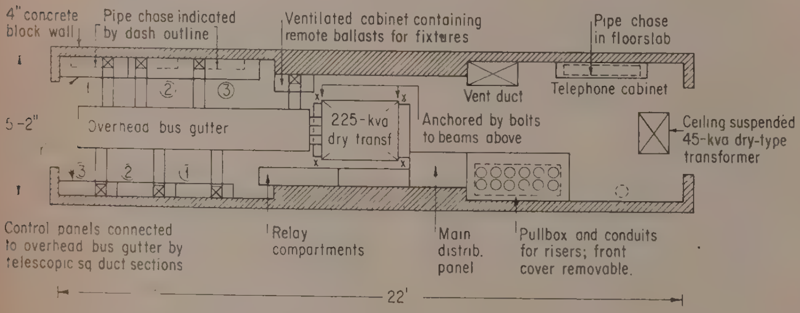
Raceways are run concealed except in service areas. Galvanized rigid steel conduit was installed for power feeders placed in concrete, wet locations or where exposed to mechanical injury. EMT was used generally for branch-circuit control and signal wiring.

Where conduit expansion fittings are used to cross structural joints, conduits are solidly anchored on both sides of the fittings. And, where conduits turn up through floorslabs to connect with electrical cabinets or equipment, connection couplings are set flush with slabs.

Circuit wiring is consistently color coded, numbered and tagged after pulling, with sufficient spare wire provided in outlet and junction boxes to permit *several* splices to be


All lighting fixtures over moving stairs are recessed 3-lamp units with ballasts located in remote cabinets and with no-light-leak trim.
Vent grille
Fixture on emergency circuit
Fixture on normal circuit
Access panel
Typical electric room (see detail below)
Fixtures shown with crosshatching are located on sloping ceilings

TYPICAL FLOOR PLAN SHOWING ELECTRIC ROOM INSIDE STAIRWAY WELL


4" concrete block wall
Pipe chase indicated by dash outline
Ventilated cabinet containing remote ballasts for fixtures
Pipe chase in floorslab
2
3
Vent duct
Telephone cabinet
5'-2"
Overhead bus gutter
225-kva dry transf
Anchored by bolts to beams above
Ceiling suspended 45-kva dry-type transformer
3
2
1
Control panels connected to overhead bus gutter by telescopic sq duct sections
Relay compartments
Main distrib. panel
Pullbox and conduits for risers; front cover removable.
22'

DETAIL OF TYPICAL ELECTRIC ROOM SHOWING PLACEMENT OF EQUIPMENT

ELECTRIC ROOMS for each floor are centrally located within flanking moving stairway. Risers, pullboxes, panelboards, relay and ballast compartments are racked along walls, while secondary transformers are ceiling-suspended, and related wiring is carried to respective panels via oversized overhead gutters and bent-knee sections of square duct.

remade with the same wire, should subsequent reconnections or control rearrangements be desired. Splices for branch wiring (No. 10 and smaller) are generally made by either insulated screw-on connectors, or connectors containing spiral metal inserts within insulated caps. Circuit splices and taps for large conductors are made with compression-type connectors which are then encapsulated and insulated with rubber tape plus friction tape and weatherproof asphaltum.

Stairway Lighting

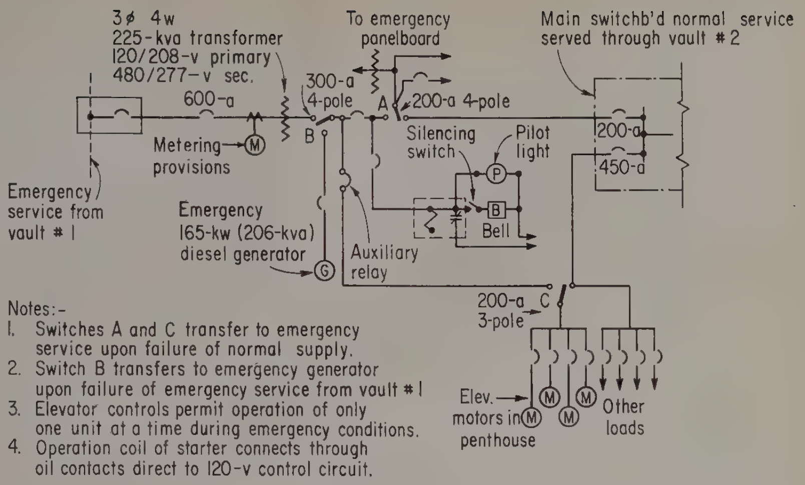
Over moving stairway and adjacent areas, high intensity illumination is provided by ceiling-recessed 277-volt 3-lamp fluorescent fixtures with light-tight trim. Eight fixtures over each pair of moving stairway sections are connected to normal service, with eight additional units connected to emergency circuits. Ballasts are located remotely in adjacent electric rooms. The ballasts are mounted in two banks in ventilated cabinets formed from perforated 10-gage steel with expanded metal doors. Vertical central partitions of perforated fiberboard serve as terminal boards and also segregate emergency from normal circuit wiring.

Both normal power and emergency lighting circuits, controlled from each floor's electric room, extend part way up and part way down inclined ceilings above moving stairways. This means that if a single floor were to go dark, illumination of moving stairway areas still would be provided from fixtures connected to circuits from the floors above and below.

Sound Systems

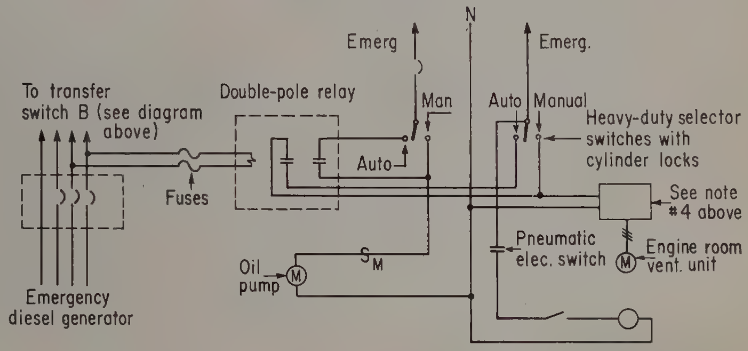
A comprehensive sound system centers around a master equipment room containing microphones for announcements, automatic record changer, AM-FM tuners, tape decks and other related equipment.

Engineering and architectural details for this $30-million project were prepared by John Graham of Seattle; Noel Rankin serving as electrical inspector. Electrical work in the Meier & Frank store was performed by W. R. Grasle; Ed Kozlowski serving as job superintendent; E. Appleton as coordinator, and Tom Kommers as project engineer.



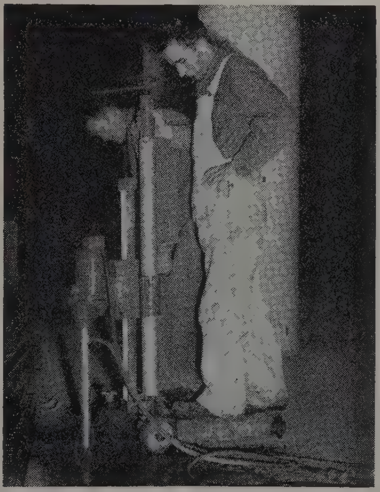
Notes:-
1. Switches A and C transfer to emergency service upon failure of normal supply.
2. Switch B transfers to emergency generator upon failure of emergency service from vault # 1
3. Elevator controls permit operation of only one unit at a time during emergency conditions.
4. Operation coil of starter connects through oil contacts direct to 120-v control circuit.

EMERGENCY SYSTEM



DIESEL GENERATOR AUXILIARY EQUIPMENT

EMERGENCY loads served normally through Vault No. 2 are automatically transferred to Vault No. 1 switchgear in event of partial power failure, while diesel generator is provided to insure against total outage. Since secondary voltages of the two vaults are not the same, an intermediate step-up transformer is located as indicated in the connection schematic.



DIAMOND CORE DRILLS were used to cut through floorslabs in cases where outlets were desired in areas not equipped with underfloor ducts. In such cases outlet boxes were connected to each other and to distribution panels by conduits run beneath slabs.

UNDERFLOOR DUCT system had to be modified after its initial installation, due to in-progress switch from vinyl to terrazzo as floor surface. This change altered the finished floor elevation, necessitating replacement of some 2000 inserts; a problem solved by cutting standard conduit couplings in half and using running thread nipples.

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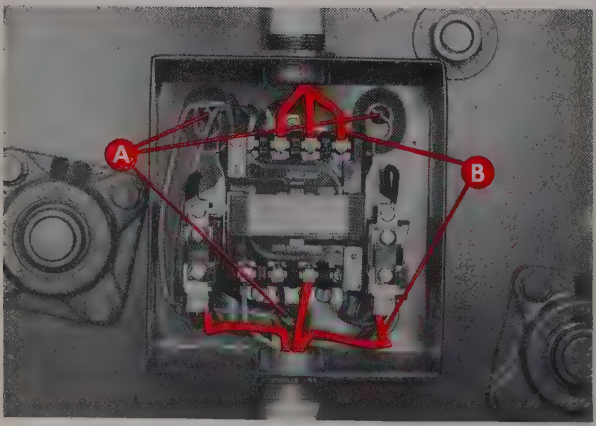

(A) Three-point mounting
(B) Straight-through wiring (wiring on left side is control circuit)

General Electric 100-Line starters and contactor Sizes 00 through 5, reduce your one large installatio expense—time.

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- All 100-Line starters feature straight-through wiring. Wires don't have to be bent around the device Result—you save time and wire—up to $8.00 on Siz 5 installations.
- Out-in-front, pressure-type terminals facilitat hookup. Terminals are solidly anchored—won't swivel, causing screwdriver slippage; wire is held firmly Terminals accept solid or stranded wire, ring or spad connectors.

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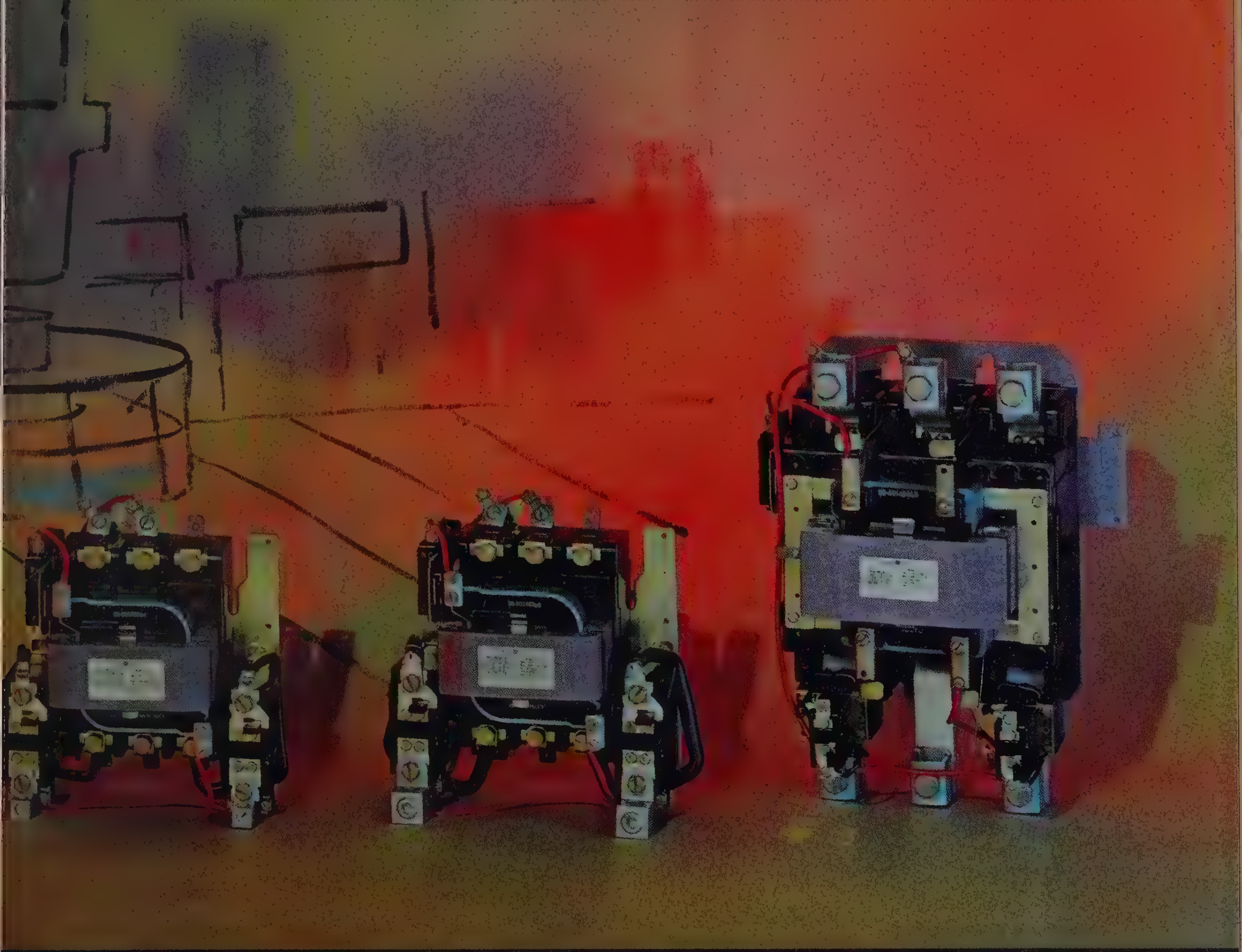

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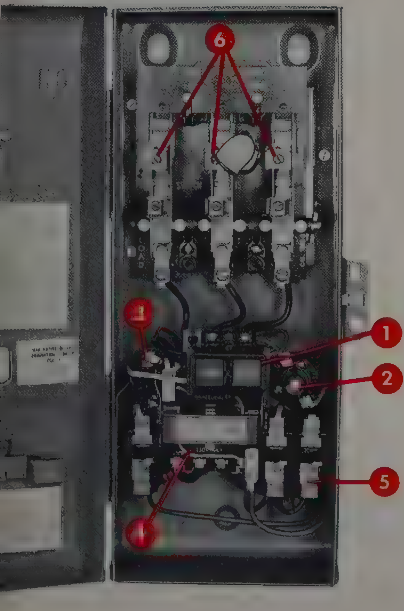

G-E MODIFICATION KITS—the industry's widest selection—permit you to modify all starter forms on the spot and reduce the size of your inventory. Kits (see photo) include: new "square look" (1) pushbutton or selector switch and (2) indicating light for cover installation—all covers have knockouts for these kits; (3) auxiliary contacts; (4) strongbox coil; (5) third overload relay; and (6) fuse clips for combination starters. Vertical or horizontal mechanical interlocking kits are also available for Sizes 0, 1, and 2.

OVERLOAD RELAYS on all 100-Line starters can be adjusted from 85% to 115% of nominal heater rating. Relays also can be set for manual or automatic reset.

For more information on General Electric's complete line of contactors, across-the-line and combination starters, reversers, and multi-speed controllers, contact your G-E Distributor, or write for publication GEA-7020, Section 813-40, General Electric Company, Schenectady 5, N. Y.

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GENERAL ELECTRIC

SIX 4-KW INFRARED heating units are suspended above centerline of large mountain lodge to provide warmth to camping and conference groups throughout the year. All-electric facilities of this recreation center also include electric water heaters, pumps, ranges, disposal units, refrigerators and the like. Lodge is located in North Fork of Ogden Valley, Utah.

Radiant Heating Included In Rustic Lodge Design

Located in North Fork Canyon near Ogden, Utah, is an attractive redwood lodge used throughout the year by groups of Latter Day Saints for a wide variety of winter and summer activities. This rustic lodge makes "roughing it" a pleasure, because its all-electric pedigree includes such items as electric space heating, cooking, refrigeration, water heating, pumping and lighting.

As noted in the photo, space heating is provided by six 4-kw radiant reflector fixtures suspended beneath the roof apex of this 75- by 25-ft area, while a 26- by 26-ft wing and six adjacent cabins also are fully electrically heated in this same manner.

Since construction of the lodge is of milled tongue-and-groove prefabricated "logs," with insulation packed around door and window frames, the building is reasonably airtight and comfortably warm even during the low temperatures of snow season.

Complex Conduit Installation Speeded By Pre-Assembled Mock-Up

An unusually large, complex installation of conduit was recently placed underground, then cast in concrete, by first assembling this section of the raceway system above ground, then lowering it as a unit by crane prior to concreting and backfilling. This technique, plus several other construction innovations, effected considerable savings in both time and labor on a project involving a quarter-million ft of wire and cable.

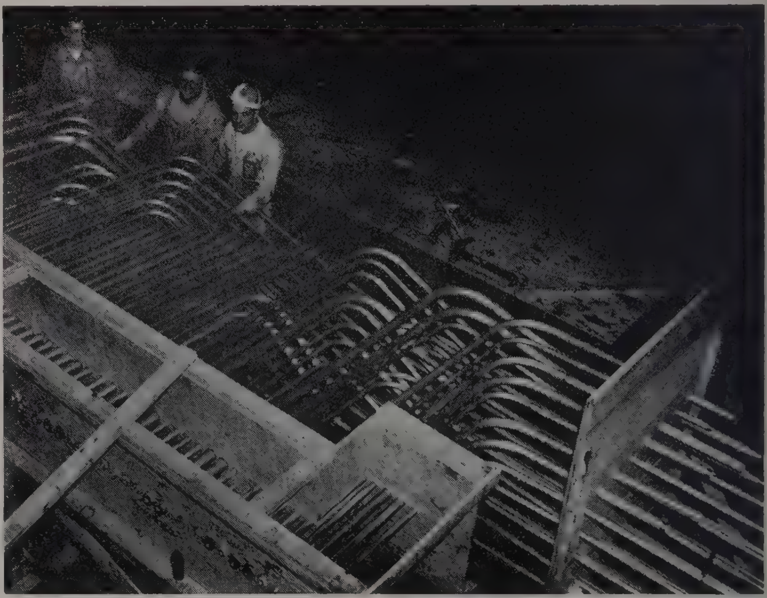
The practical method here discussed involves the extension of 148 runs of rigid aluminum conduit from a 22-ft-long gutter beneath a large dc panel, through a basement wall, with bends at right angles to permit subsequent extensions to turn up at various points beneath a fully-automatic production line in a sheet-metal rolling mill. Of the 148 right-angle bends, 108 turn in one direction and 40 take the opposite. In addition, this project was complicated by the fact that all conduit had to be buried at least 15 in. below plant-floor level. Conduit groupings had to be as compact as possible to minimize excavation work, and some of the conduit runs had to cross between other runs in the backfill.

This assignment was practically approached by first blocking out an upper section of the basement wall, using a double plywood template which would support the conduit in desired positions and also serve as a concrete form for the wall. This template was reinforced with 2 by 4s as indicated in the accompanying photo, then wing templates of plywood were secured at 90-degree angles at either end to complete the mock-up unit. For easy accessibility, the mock-up was constructed on the main floor of the plant adjacent to its intended buried location.

With templates so arranged, conduit was first carried through the wall templates in two tiers with 6-in. spacing between conduit centers both horizontally and vertically. Right-angle bends were then arranged so that nine tiers of 12 conduits each turned to pierce the south template, with five tiers of eight conduits each turning north. About 20% of these bends had to be offset as well in order to accomplish the desired configuration.

In this preassembled section, a total of 3700 ft of conduit was used: 3200 ft being $1\frac{1}{2}$-in.; 250 ft being 1-in.; 150 ft being 3-in.; and 100 ft being 2-in. Conduit was aluminum, having a gross weight of 3800 lbs.

After conduit was completely installed in mock-up form, a 26-ft-long I-beam was placed atop the main template, with similar, but



BANK OF 148 CONDUITS was first positioned on template mock-up constructed on main floor of new rolling mill under construction, then entire assembly was reinforced by I-beams, lifted by crane and lowered into excavated trench. Double plywood template in foreground coincides with gap in basement wall. After placement in desired location beneath main dc panel, concrete was poured between these forms to solidify the wall section.

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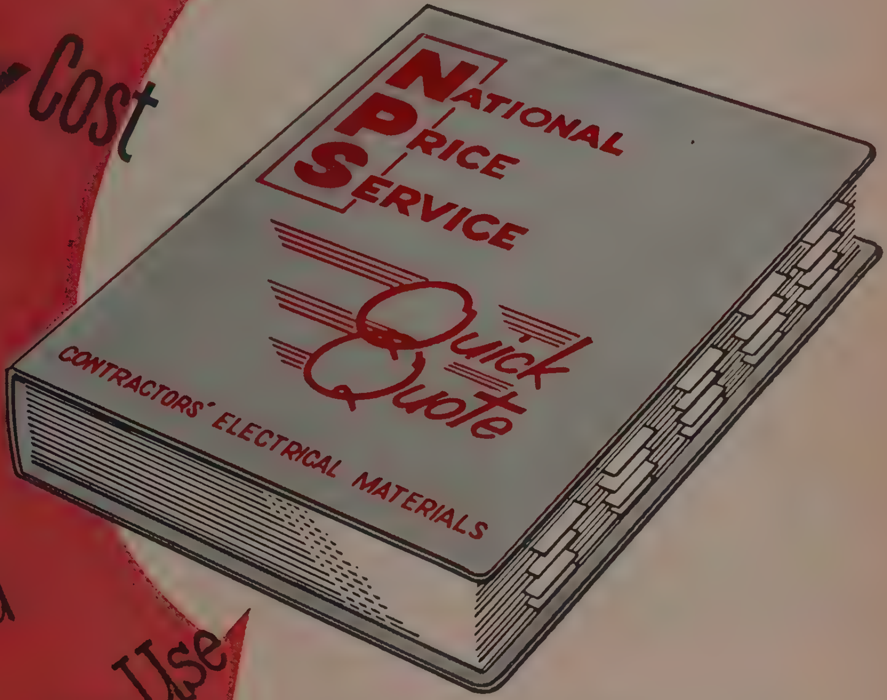

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shorter beams positioned above wing templates. Templates and conduits were then secured to beams with 1½-in. steel straps; beam spacing and relative positioning was maintained by welding angle iron between them, then the entire unit was picked up by crane and set into place. Sand backfill was then placed around the bent sections of conduit to support them in place; I-beams and straps were removed; then concrete was poured to unify the basement wall section and the main floor of the plant.

This mock-up was built and conduits were installed in 200 man-hours, with an additional 48 man-hours for rigging and final placement. Installation was by a crew of eight plant electricians under the supervision of electrical maintenance foreman, Raleigh W. Smith, who estimated that approximately a week of time was saved by using the floor-based mock-up approach where maximum accessibility was possible, rather than attempting to install conduit directly in its ultimate sub-floor location.

Smith likewise estimated that a time saving of 35-40% resulted from performing this part of the job with aluminum, since rigging could be lighter and bends and offsets were easily obtained.

After conduit was installed, heavy cotton cords were blown through raceways with air pressure and, in most instances, conductors could be pulled-in directly by these cords to further reduce installation times. For this section of the work, wire was predominantly No. 12, delivered in bulk on 5000-ft reels, then pre-marked prior to cutting in order to minimize possible errors in later identification. The plant, just completed for Kaiser, is located at Trentwood, near Spokane, Wash.

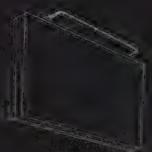
Vibration Isolating Pads Solve Transformer Noise Problem

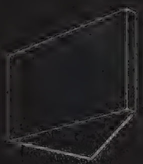
The new 42-story Equitable Life office building, located in New York City, reflects the modern trend for power distribution systems in buildings of this size. Following sound engineering practices, the 460Y/265-volt power supply economically handles the large fluorescent lighting and air conditioning load at this voltage. On the other hand, there is still a demand for lower utilization voltages to serve 120-volt office equipment. This is ac-

RECESSED

END MOUNT

PENDANT


TOP MOUNT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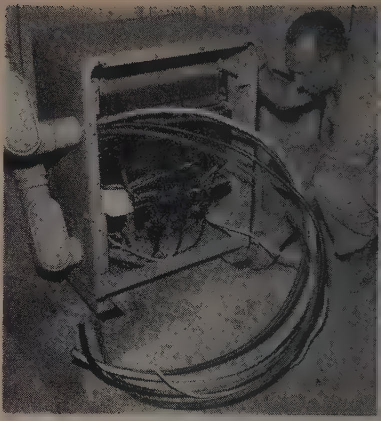

MECHANIC INSPECTS cross-ribbed, neoprene vibration isolating pads installed under each angle-iron support for typical dry-type transformers in New York's new 42-story Equitable Life building. The 5/16-in. thick isolating pads prevent acoustical amplification of transformer noise and vibration and subsequent transmission through structural members.

complished by the use of 3-phase transformers, which step down the 460-volt supply to 208Y/120 volts. For the Equitable building, 150 such transformers were installed.

With these transformers, particularly in an office building where several units are installed on each floor, engineers immediately recognized the problem that could arise with transformer noise, because studies have shown that annoying background noise cuts the efficiency of office workers. They effectively solved the problem through the use of simple vibration isolation techniques. The key to the solution was an inexpensive, cross-ribbed, vibration isolating pad made of neoprene. Installation involved cutting the $\frac{5}{16}$-in. thick pad to size with scissors and placing it uniformly under the two channel irons supporting each 600-pound dry-type transformer. This simple procedure requires no bolts, fasteners or hangers of any type.

In addition, each floor-mounted transformer was connected by short lengths of liquid-tight, flexible metallic conduit, which also helped to reduce vibration and noise transmission.

Original engineering calculations set the operating noise level of the transformers at about 40 decibels. The combined effect of the 60-cycle hum of 150 3-phase units transmitted through the building's structural members could have produced a noise level considerably above the acceptable limit.

To avoid this possibility, Meyer Strong & Jones, New York City, the electrical consulting engineers

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TWO DRY-TYPE TRANSFORMERS, each rated at 75 kva, are typical of 600 such units installed by Lord Electric Co. in the Equitable Life building in New York City. In addition to the use of cross-ribbed, neoprene isolating pads between the floor and transformer angle-iron supports, conduit connections include a short length of liquid-tight flexible metallic conduit. Both techniques made it possible to minimize transformer noise and vibration.

for the buildings, recommended to Turner Construction, the general contractor, that MB Isomode vibration isolating pads, manufactured by MB Electronics, New Haven, Conn., be used to solve the noise transmission problem. For years these crossed-ribbed neoprene pads have been used as a standard vibration isolating material under numerous machines in a variety of industries.

According to Lord Electric Co., the electrical contractor for the building, the effectiveness of the pad as a vibration and noise isolator for transformers depends on proper loading. The pad must be compressed to be effective. MB Electronics recommended a loading rate of 50 psi for this particular application. Since each transformer weighed 600 lbs, approximately 12 sq in. of pad were needed under each unit to achieve the proper loading rate.

Divided into two equal strips, the pads were placed under the two channel irons forming the transformer mounting. A single layer of pad proved effective. In this case, the nature of the disturbing frequency was such that only one pad was needed to isolate vibration. In other cases, where the disturbing frequency causing vibration and sound is only a few hundred cycles per minute or less, several layers of pad may be needed.

Since the pad is made of neoprene, it is relatively non-aging and is resistant to industrial greases, oils, and other chemicals, cleaning solutions and detergents. The pad has an estimated useful life of over 20 years.

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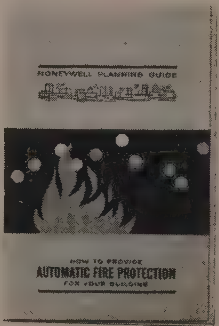
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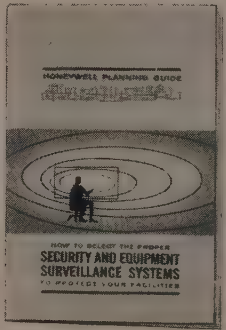
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Honeywell Smoke Sentry*!

Smoke Sentry matched against all major types of fire detectors by Los Angeles Fire Department. Sounded alarm first in 8 out of 10 fires.

Acting under the supervision of the National Fire Protection Association, the Los Angeles Fire Department set a total of 102 fires in the condemned school shown at left.

Chief purpose of one series of tests was to measure the response time of automatic fire detectors. In 8 out of 10 of these tests, Honeywell's Smoke Sentry was the *first* to detect fire. And in one test, involving a near explosive-type atmosphere, the Smoke Sentry triggered the alarm just one second after the fire was started.

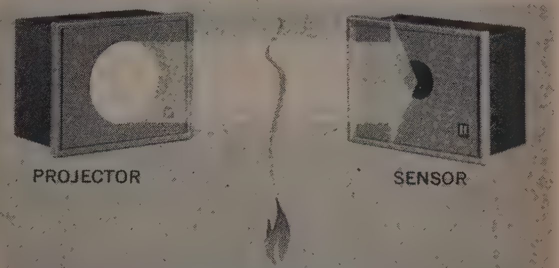
Why such unusually fast response? Honeywell's Smoke Sentry isn't actuated by what can be a relatively slow increase in room temperature. It detects smoke . . . the first sign of fire!

Despite its extreme sensitivity, a built-in time delay eliminates false alarms that could be caused by an object, such as the top of a ladder, passing through its watchful beam. And the Smoke Sentry can be set for different densities of smoke to protect different types of areas.

We suggest you investigate Honeywell's Smoke Sentry for your jobs. It gives your customers a vital extra margin of safety . . . yet it costs no more than many other types.

Your customers' price for one Smoke Sentry set adequate to protect one stairwell or an area up to 30 ft. wide by 150 ft. long is approximately $200. Price includes projector, sensor, power supervisory panel and a constant voltage transformer.

Your nearest Honeywell Office will be glad to furnish complete information at no obligation. Or, if you prefer, mail the coupon below for the Planning Guide on "Fire Detection and Alarm" plus any others you would like. *Sales and service offices in all principal cities of the world.*



BEAM-OF-LIGHT SMOKE DETECTION. Smoke Sentry sounds the alarm fastest, adds extra life-saving minutes for evacuation time. Basic unit consists of a projector and a sensor. In large installations, an annunciator panel is used to pinpoint fire location

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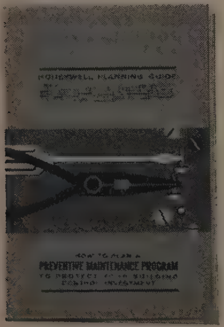

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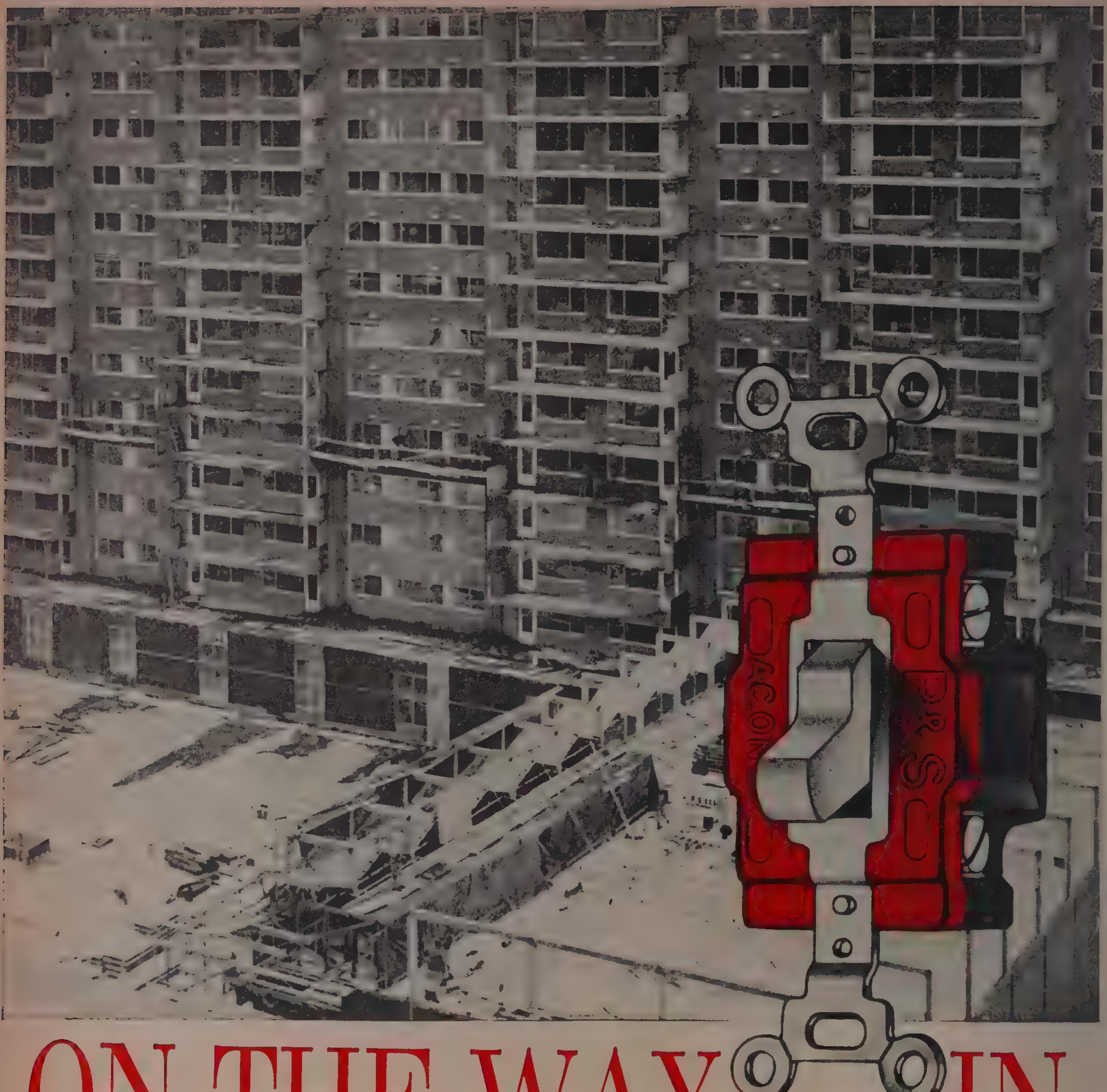

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LARGE STOCK of motor and motor-drive parts encourages customers to bring their motor-repair business to the James J. Burman Electric Motor Service Co., Riverhead, N. Y. Photo shows small section of parts department, which extends the full length of the shop on one wall.

Small Parts Stock Aids Motor Business

Serving the farming community of eastern Long Island on the north shore, the James J. Burman Electric Motor Service Co., Riverhead, N. Y., augments their motor winding business with an impressive stock of V-belts, pulleys, pump parts, motor-control parts, grommets and other related components used with motors, pumps and drives. Sales for such parts are common in this area.

According to James Burman, owner of the shop, he has increased his small parts stock throughout the years to handle the growing needs of the surrounding communities. Small parts are neatly placed in open bins that are numbered to simplify inventory. Burman finds that having a good stock of mechanical parts available for his customers generally results in getting their motor-repair business also. As parts customers enter the establishment, they can't help but notice the well-equipped shop set up to handle large and small motor rewinds alike.

One shop innovation concerns the baking oven. This operation is performed in a separate vented rear room to keep fumes from the shop and stock area. The rear room is adequately vented to the outside of the building.

LONG WORK BENCH is well-equipped to put finishing touches on repair jobs. Coil winder, test equipment and hand tools are conveniently located. Stator resting on bench is for a 2-phase 1-hp motor which is being rewound.

OWNER BURMAN sets an electric bake oven, located in a separate vented room at the rear of shop. Odors from baking operation are kept out of the main shop area and parts department through isolation and adequate ventilation.

Fast Service Cuts Downtime

The Benjamin Electrical Engineering Works Inc., New York City, received an emergency call on a Friday morning that a 300-hp, direct-coupled 850-rpm 3-phase motor, operating a plastic molding machine, was out of order. The customer requested immediate service.

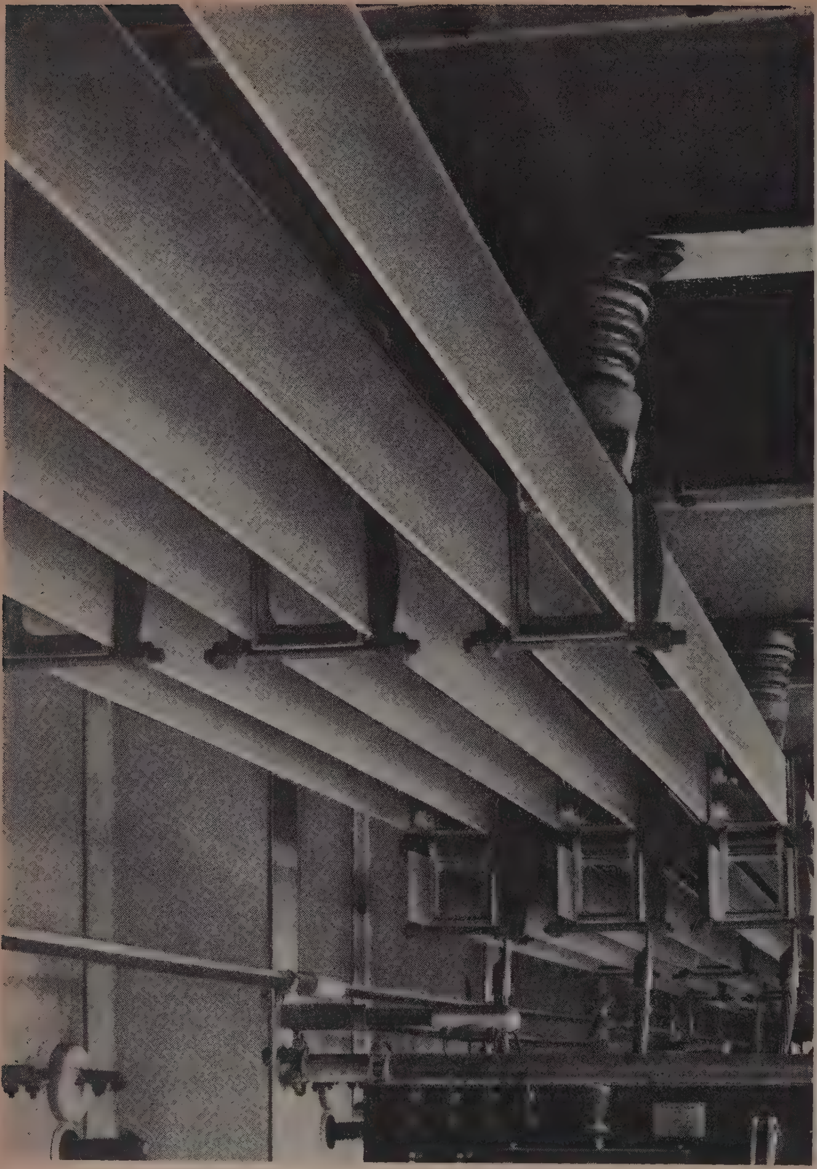
Two Benjamin mechanics were immediately sent to the job in an emergency truck. Examining the motor, which was located 20 ft above the main floor, they found broken roller bearings, shafts badly worn, and the rotor rubbing on the stator. They immediately called for riggers and rigging equipment, removed the 2-ton rotor, and transported it to the shop. There the rotor shafts were built up, machined, and fitted with new roller bearings. Then the reconditioned rotor was transported back to the job.

During the time shop work was being done, two mechanics at the job site dressed up stator laminations after pressure cleaning them with degreasing solvent. Then they air-dried and varnished the stator winding. When the rotor arrived from the shop, they installed the rotor, assembled the motor, coupled the motor to the gear housing, and made final tests. The entire job was completed by the following Sunday, and a satisfied customer was ready to resume normal operation with a minimum loss of production.

Motor Shop Features Effective Layout and Custom Tools

Bjorn Boye, owner of Mastic Electric Motor Service, Mastic Beach, N. Y., believes that one of the major factors of a successful business is a neat shop layout with proper tools to speed up repair jobs and produce quality work.

This shop is impressively arranged to process work in the shortest possible time. As an example, the front half of the building consists of an office and garage. For pick up and delivery, a service truck backs into the garage where the floor level is the same as the rear shop area. With this arrange-



This bus costs half as much as copper

It's aluminum, of course. It weighs less than half as much as copper (for equivalent capacity). It's easy to bend, form, drill, cut, punch and weld. And bolted joints of aluminum to aluminum or aluminum to copper are easily made with standard procedures. ☐ It's corrosion resistant, too . . . even in highly contaminated atmospheres such as exist in or near chemical and other industrial plants and in sea coast locations. ☐ Before you expand or modernize your capacity, get all the facts about Alcoa aluminum bus conductor. We supply it in a wide variety of shapes and sizes for all applications. Just call or write your Rome-Alcoa representative or Rome Cable Division of Alcoa, Dept. 7-62, Rome, New York.

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CUSTOM BAKE OVEN was built from a well-insulated refrigerator. Timer and thermostat controls are located in lower compartment while three 250-watt heat lamps provide heat in oven compartment. A capillary tube senses temperature in oven to provide accurate settings and heat control.

ment, equipment is easily raised or lowered via a ½-ton overhead hoist, which slides along a 2-ton-capacity beam from the loading area to the disassembly bench in the rear of the shop.

When motors arrive at the disassembly bench, tests are made to determine defects. After this, the motor can be moved to the proper repair department on the castered disassembly bench.

The bake oven, hydraulic press for removing bearings, 300-amp welder and lathe are located close to the disassembly bench. The winding department is at one end of the shop, isolated from other shop operations.

And a noteworthy feature is that excellent housekeeping prevails at all times, since Boye feels that a clean shop leaves a good impression

BJORN BOYE, owner of Mastic Electric Motor Service, demonstrates the portable stator holder he designed to simplify work on field coils. Extension phone, test equipment and small parts bins are close at hand.

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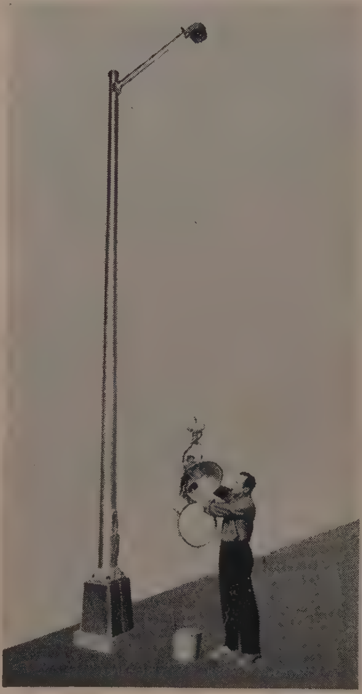

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THE THOMPSON ELECTRIC COMPANY
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HYDRAULIC PRESS, located near disassembly bench, speeds up bearing replacements. Grinder, lathe, drill press, welder, and bake oven are also in this area of the shop. Rewinding department is situated in an isolated section.

with customers visiting the shop area.

Boye designed and built several shop tools and equipment. For example, the bake oven was made from an old refrigerator that had good insulation around the storage compartment and in the door. At the top of the baking chamber, three 250-watt, 120-volt heat lamps provide the necessary heat for baking coils. Located in the lower compartment, previously occupied by a compressor unit, are a timer and thermostat. A capillary tube extends into the oven to transmit accurate temperature readings to the thermostat. Average baking cycles run six hours at a temperature of 275°F. And from the rear of the oven, a vent extends through an adjacent outside wall.

For use at the small-motor bench is a specially designed stator holder constructed similar to a small drill press stand (see accompanying photo). A ½-in. thick steel base plate has a C-clamp connection, which fastens to the bench. From the top of the base plate two vertical pipes extend upward. The front pipe, about 6 in. high, is attached to an upper base plate, which serves as a seat for a stator assembly. A rear pipe extends 30 in. vertically, and an adjustable "T" pipe assembly slides over it and can be adjusted at any height by tightening an attached, set-screw hand wrench.

Extending horizontally from the adjustable pipe sleeve is a short length of pipe containing a welded head tapped to receive a threaded vertical stem. The knob for the threaded stem is an old bearing welded solidly to the unit. Turning the knob clockwise provides a clamping action, which securely holds a stator in place while inserting coils. This unique tool permits

CANADIAN ELECTRICAL contractors Claude Tousignant (left), Ultra Electric, Hull, Quebec; and Antoine Gregoire (right), president, Corporation of Master Electricians, Province of Quebec, Montreal; exchange practical information with John McLaughlin, Kelso-Burnett Electric Co., Chicago, at recent NEMA Electric Comfort Heating Symposium in Chicago.

adequate space to work on the stator without obstructions. And when the holder is not in use it can be quickly removed and stored under the work bench, thus allowing full bench space for other projects.

At this same work bench, test sockets and leads, coil resistors and receptacles are conveniently located. And a wall phone is adjacent to the bench so calls can be received without going to the front office. In addition, small parts bins are located at arms' length.

According to Boye, their efficient shop operation is the result of careful selection of tools and equipment, proper layout, and an eye for better tools or techniques to reduce labor costs while still maintaining high-quality workmanship.

UL STANDARDS for electric space heating equipment are concerned primarily with safety, H. B. Whitaker, vice president and chief electrical engineer, Underwriters' Laboratories, Inc., New York, tells seminar at NEMA Electric Comfort Heating Symposium in Chicago. Other speakers emphasized that product quality, performance and efficiency are the responsibility of the manufacturers (NEMA Standards).

For fastening to masonry

There are three things needed to fasten to masonry: drills, anchors and screws. And they are all here in this one sturdy, re-usable box—The Rawl Contractor's Kit. Each kit contains a high quality Rawl Spiral Carbide-Tipped Drill, 100 genuine Rawlplugs and 100 matching screws. You'll never be on the job with something missing if you have a Rawl Contractor's Kit. Available from your distributor, or if you prefer, use the handy coupon below.

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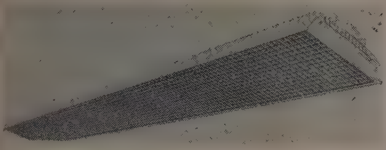
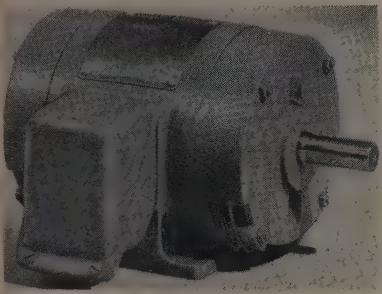


Lighting Fixture (1)

A new series of surface-mounted fluorescent lighting fixtures, the Grandview II and IV, has been announced. Grandview II, available in 10-in. by 4-ft and 10-in. by 8-ft sizes, accommodates two fluorescent lamps. When equipped with rapid-start lamps and approved ballast, it is UL listed for direct mounting to any ceiling, including low-density combustible fiberboard. Grandview IV for mounting to all ceilings except combustible, is available in 14-in. by 4-ft and 14-in. by 8 ft sizes and accommodates two, three or four fluorescent lamps.

Day-Brite Lighting, Inc., 6260 *N. Broadway, St. Louis* 15, *Mo.*



Motors (2)

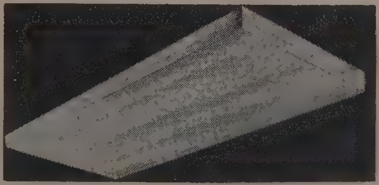
New additions to the Tri-Clad "55" line of ac motors are now available in ½ to 7½ hp ratings. The 140 diameter line offers a choice of single or polyphase design in dripproof or totally enclosed, fan-cooled construction for 3-phase, 60-cycle ratings from ½ to 3 hp and single phase, 60-cycle ratings from ½ to 7½ hp. Normal customer service is available initially on polyphase motors, Type K (NEMA Design B, normal starting torque) in 60-cycle, 3600, 1800 and 1200 rpm, horizontal, ball bearing designs in dripproof or totally enclosed, fan cooled, and foot-mounted or round frame, C flange construction; and on single phase motors, Type KC (NEMA Design L, normal starting torque) in 60 cycle, 3600 and 1800 rpm, horizontal, foot-mounted, and round frame, ball bearing, dripproof construction.

General Electric Co., Schenectady 5, *N. Y.*

Transformer (3)

A new line of 3-phase transformers, rated 750 kva through 1500 kva, 15 kv and below, is designed to accommodate increasing load demands of distribution systems. Distribution center is small and lightweight, has lower impedances, higher short-circuit strength.

Allis-Chalmers Manufacturing Co., Milwaukee 1, *Wis.*



Fluorescent Unit (4)

The new "Clipper" line of commercial fluorescent modular units has been introduced. A sculptured offset in the vertical sides of the fixtures reduces the apparent depth of the shallow 4⅛-in. units. Light leaks are prevented by a special push-back end rail that is also hinged. The surface mounted "Clipper" series is available in 1 by 4, 2 by 2, 2 by 4, and 4 by 4, 2- and 4-lamp 40-watt rapid start arrangements. The 4 by 4 is available in 4-, 6- or 8-lamp construction.

Benjamin Division of Thomas Industries Inc., Louisville, Ky.

Speaker (5)

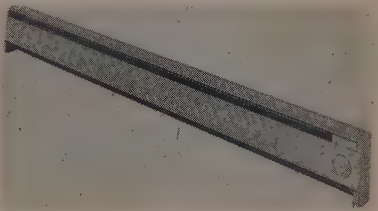
A new multi-purpose pillow speaker unit, which provides hospital patients with convenient remote control of radio and television programs and nurses' call, has been announced. Speaker unit provides broadcast entertainment and television reception directly to the listening individual. Low-level sound does not disturb other patients. Speaker unit offers four separate controls—radio station selector; television channel selector; volume control; and nurses' call. Radio and television selectors are rocker-type switches. The 2¾-in. dynamic speaker has a full frequency range. Entire speaker unit, including its 8-ft plastic-covered cord and plug can be easily sterilized. Accidental removal of the pillow speaker plug automatically registers a nurse call.

Auth Electric Co., Inc., 34-20 *45th St., Long Island City* 1, *N. Y.*

Cable Tray (6)

A new ladder type cable carrier called Ventray is designed to support power and multi-conductor cables. Made in standard lengths of 12 ft and standard widths of 6, 12, 18 and 24 in., Ventray cable carrier sections are interchangeable with the Husky line of Ventrib cable basket sections providing maximum system flexibility. Rungs spaced 9 in. apart are resistance welded to side stringers. All sections are available either pre-galvanized or hot-dip galvanized after fabrication.

Husky Products Inc., a division of Burndy Corp., Cincinnati, Ohio

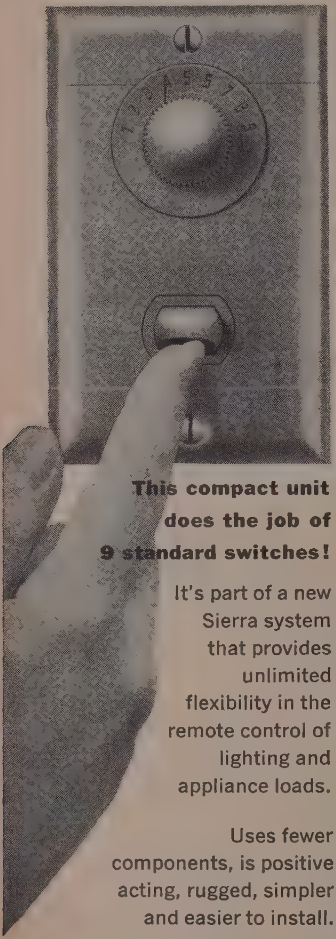


Control (7)

The "LC" (linear control) is available in all custom-line (H570-LC Series) baseboard heaters and marked modular baseboard system electric heating equipment. When air flow is restricted in any way, "LC" automatically limits the heater to the safe normal operating temperature. It does not permit the heater to exceed normal operating temperature, even when completely or partially blocked. When the air-blocking material is removed, the "LC" automatically returns the temperature control to the thermostat. It is available in complete baseboard units from 3 ft (750 watts) to 8 ft (2,000 watts). It is also available in modular systems for commercial and industrial installations.

Markel Electric Products, Inc., Buffalo, N. Y.

SIERRA
REMOTE
CONTROL
WIRING



**This compact unit
does the job of
9 standard switches!**

It's part of a new
Sierra system
that provides
unlimited
flexibility in the
remote control of
lighting and
appliance loads.

Uses fewer
components, is positive
acting, rugged, simpler
and easier to install.

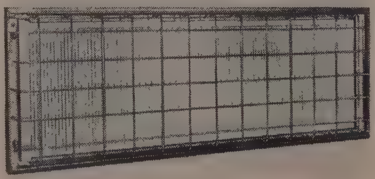
Adds value far beyond
its low cost. Write
for details today.

SIERRA ELECTRIC
CORPORATION
15100 SOUTH FIGUEROA STREET
BOX 85, GARDENA, CALIFORNIA
Write for more information and catalog

Cable Fault Finder (8)

Cable faults can be located safely with the new Johnson impulse fault locator. It employs the principle of sending surges for audible detection. Known as Model 82-C, the portable unit is particularly applicable for power, lighting, control and communication cables in ducts or buried in the ground, also for portable and aerial type cables. It locates the fault by impulses of high dc voltage. Capacity of fault finder is 15 kv dc, adjustable over the full range. Input is 120 volts, 60 cycles, single-phase.

Multi-Amp Div., Multi-Amp Electronic Corp., 61 *Myrtle St., Cranford, N. J.*



Heating System (9)

A new, automatic, location-controlled, electric radiant glass panel heating system has been announced. Utilizing heating units of various capacities under the control of a master thermostat, individual room control is accomplished by additional thermostats placed in rooms used more frequently than others. Individual units are designed for installation in walls or ceilings and so designed that they can be connected into standard air conditioning wiring.

Zell-Aire Corp., Reading, Pa.

Mercury Lamps (10)

Development of a new type of "rough service" mercury lamp providing extra protection against extreme vibration and shock has been announced. Available in 400-watt size at present, mercury lamp features a stamped unitized frame. Frame is stamped from a single piece of metal. It is rated at 12,000 hrs, delivers up to 86% of its original light rating after 12,000 hrs, and is available in clear, color improved or high output silver-white color improved versions. It has been designed for use in street lighting and in large industrial bays.

A choice of four functional "sealed beam" reflector mercury lamps has been added to its line. They are spot, flood, wide flood, and high beam units, all rated at an average life of 12,000 hrs and at 400 watts.

Sylvania Electric Products Inc., 730 *Third Ave., New York* 17, *N. Y.*

Limit Switch (11)

A new one-piece universal type precision limit switch is now available. It is operable in any position. The single-pole, double-throw industrial switch, designated Model 1032 F, is sealed and has no external moving parts. The one-piece design consists of a basic switch assembly and magnetic actuator contained in a common cylindrical housing of cadmium-plated steel. Housing is 1 in. in diameter and 3 in. long. Switch operates at 6 amps with 110 volts and at 3 amps with 220-volt resistive loads.

Tann Controls Co., Div. of Tann Corp., Detroit 34, *Mich.*

Cutout (12)

A 50-amp, 7.8 kv enclosed cutout (Type EU) with fault interrupting ratings up to 14,000 amps is recommended for all distribution systems, from 13.8 kv, 3-phase grounded wye down to 2.4-kv delta. Features include: wedge-type upper and lower contacts; field adjustable for either 180° dropout or nondropout operation; available with either a 50-amp fused door or a 100-amp disconnect.

Westinghouse Electric Corp., P. O. Box 2099, *Pittsburgh* 30, *Pa.*

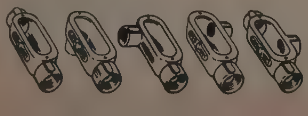
GEDNEY'S NEW "SERIES 77" CONDUIT BODIES

made of malleable iron —competitively priced!

Here's everything you have ever asked for in conduit bodies—Malleable iron ruggedness makes them virtually indestructible during installation and on the job. • A streamlined look and lightness of weight. • A durable cadmium plating and lacquer finish that glistens with "quality." • An "oval" design that will accommodate all standard covers. • Available in both rigid conduit and E.M.T. styles in sizes ½" through 2" in types "C." "LB," "LL," "LR" and "T." • **And they are priced competitively with any other conduit body you can buy!** In addition to the new "Series 77" line, Gedney is now also furnishing **all** types of threaded obround conduit bodies currently listed with a **hot dip galvanized** finish at no extra cost. • See Gedney's general catalog for a complete listing of all conduit body types in sizes through 4".

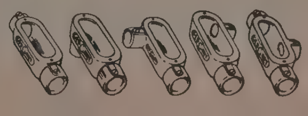
GEDNEY

For conduit clean-cut tapered threads



GEDNEY ELECTRIC COMPANY, INC.
GENERAL OFFICES: 1270 SIXTH AVE., RADIO CITY, NEW YORK 20, N.Y.
FOUNDRY, FACTORY & SHIPPING POINT: TERRYVILLE, CONNECTICUT

For EMT Hex head case hardened screws with shakeproof washers.



Exide sells all four basic types of stationary batteries. You can have low cost, long life, small space, easy maintenance. Choice depends on service requirements

EXIDE-MANCHEX
EXIDE-TYTEX (Silvium* or calcium grids)
EXIDE-IRONCLAD
EXIDE NICKEL CADMIUM (pocket positive)
Exide
Exide
Exide

Here's a fact you can be sure of. One of these Exide batteries is the type that will give you the greatest economy in your own application. But which? Which is truly your best buy? There's an easy way to find out. Ask your Exide sales engineer. He's a man with no axe to grind for any particular type, because Exide sells all the basic types. He can give you an honest recommendation. Ask him to make an engineering study of your battery requirements. It's the surest way to get the most value for your money. For literature, write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

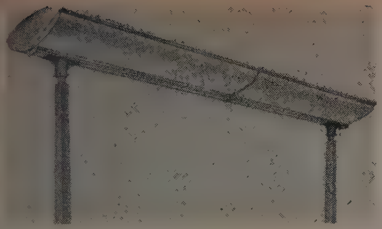
EXIDE POWER PACKAGE

Your assurance of most dependable and economical battery power. It includes the battery you should have, a charger to match, and the service you need (provided by factory-trained industrial battery specialists) all backed by Exide. It's the complete package you can buy with confidence.

**Exide's patented corrosion-resistant grid alloy*

Exide®

INDUSTRIAL MARKETING DIVISION
The Electric Storage Battery Company
ESB



Luminaire **(13)**

A new horizontal island lighter available in 6- or 8-ft lengths, each for four or six high-output or extra-high-output lamps, is offered. Called Series 8900, luminaire features wrap-around design. It can be center mounted singly, or any number of the 6- or 8-ft units can be joined in any combination to make a light source of any even length over 12 ft. Units are joined end-to-end by means of a 2-in. steel pipe support secured with four ½-in. set screws. Bulletin 900-16E is available.

Revere Electric Mfg. Co., 7420 Lehigh Ave., Chicago 48, Ill.

Timer **(14)**

New 516 Series automatic reset, repeat cycle timer is now available. Repeaters provide a variety of dial speed combinations. Two concentric dials on the 516 Series are color coded for identification, are incorporated within a single mechanism. "On" and "off" operations are independently and infinitely adjustable. The series is available in five standard dial combinations. Timers are available in 120 or 240 volts, 60 cycle. For 440- and 550-volt applications, a transformer is recommended.

Paragon Electric Co., Inc., Two Rivers, Wis.

Underfloor Raceway **(15)**

Series 15,000-A adjustable flush headerduct has been introduced as a new electrical raceway. Underfloor duct is adjustable before and during concrete pour with an adjustment range of 2⅜ in. to 3¼ in. above the cellular deck. Adjustment is accomplished with heavy leveling screws which are accessible without removing cover plates. Underfloor raceway is designed for a 2½-in. concrete fill. Made in standard widths of 9, 12, 18 and 24 in., the headerduct offers unlimited compartment arrangements to provide segregated electrical services within the raceway, and is made in all floor tile widths or in multiples of tile widths.

National Electric Div., H. K. Porter Co., Inc., Pittsburgh, Pa.

Transformers **(16)**

Dry-type transformers designed to attain the highest safety factor resulting from natural air cooling, non liquid and non toxic gases, have been announced. Transformers are available in single phase ratings from 3 to 500 kva and 3-phase ratings from 3 to 1000 kva, 15,000 volts and below, as well as phase changers 3 to 1000 kva. Catalog is available.

Atlantic Transformer Co., 8306 Hegerman St., Philadelphia 36, Pa.

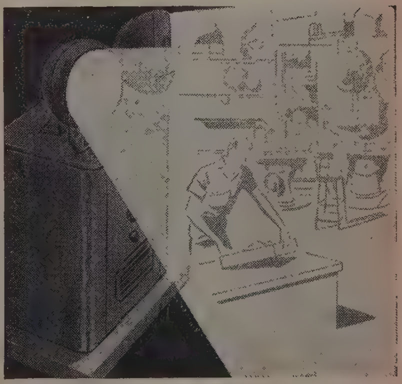
Luminaire **(17)**

A new mercury-vapor luminaire which generates nearly a quarter-million lumens of light has been introduced for use in shopping centers, parking lots, public plazas, malls and other large outdoor areas. The new Powerglow A-4000 with four 1,000-watt lamps emits 208,000 lumens of light and can illuminate an acre of area to approximately 2½ average footcandles. Unit comes in satin aluminum and five decorator colors. Recommended mounting height is 35 to 40 ft.

General Electric Co., Schenectady 5, N. Y.

LOW-COST PROTECTION

AGAINST LOSS OF LIGHT

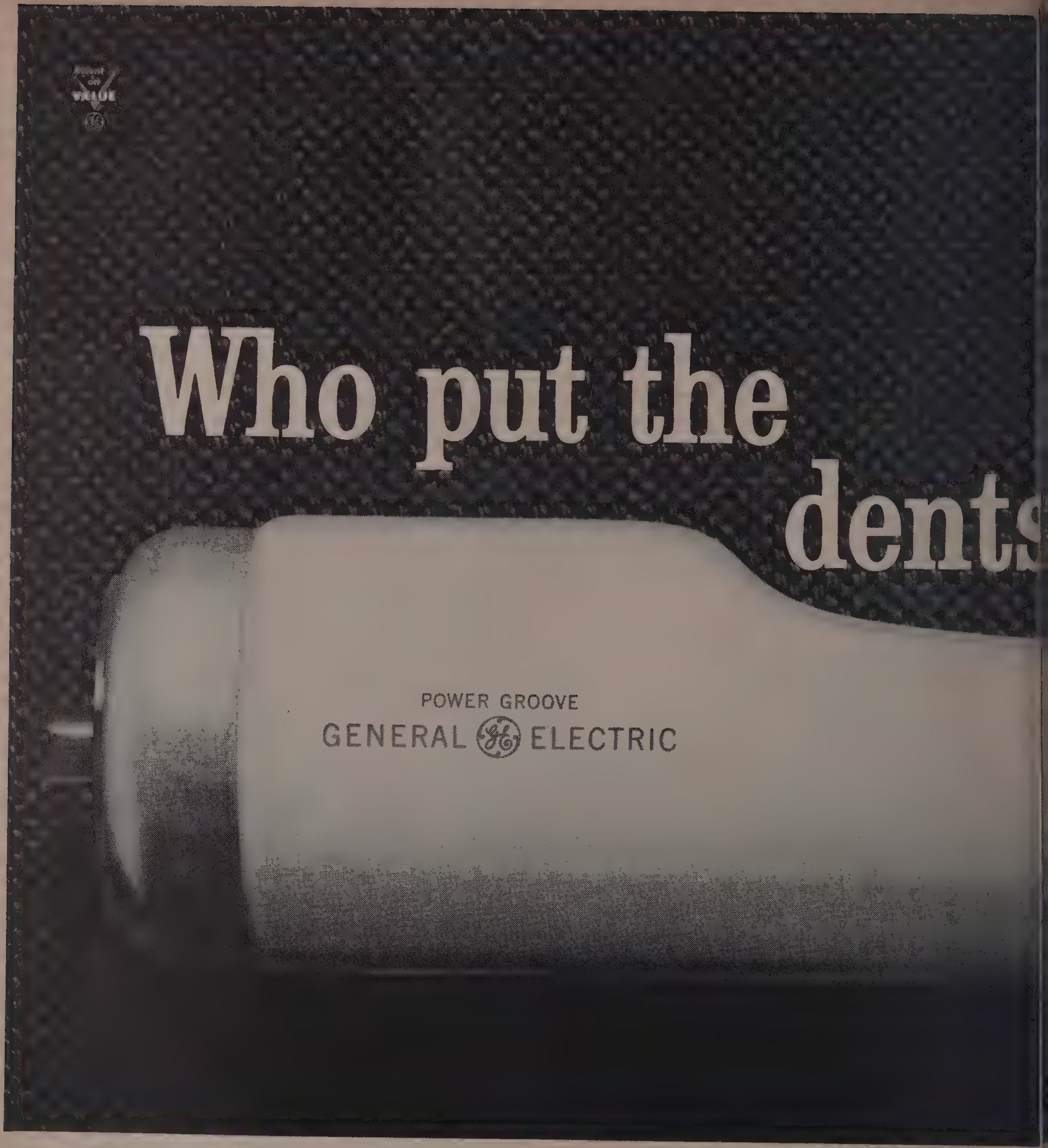


EXIDE LIGHTGUARD®

Don't run the risk of heavy losses from sudden darkness. Panic, injury to personnel and customers, damage to valuable machines, thefts, can cost $1000s. Exide Lightguard goes on instantly and automatically when regular power fails. Low in cost. Easy to install. Just plug into regular outlet. Built-in battery charger keeps it always ready for use. Several models. See them at your distributor's. Or write Exide Industrial Marketing Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®

INDUSTRIAL MARKETING DIVISION
The Electric Storage Battery Company
ESB



GENERAL ELECTRIC DID: TO GIVE YOUR CUSTOMERS LIGHTING POWER. The name of this lamp tells its story: it is the Power Groove*, the most powerful fluorescent your customers can buy. With it they can get more light more economically. Your customers can produce the best lighting levels in even the largest places, or outdoors. Or they can maintain levels with far fewer fixtures, reducing initial expense and future maintenance.

How does a dent help the Power Groove produce more light? First, it represents the way General Electric engineers learned to compress nine-feet of arc into an eight-foot tube. Next, it shows how their glass-making know-how went to work creating this distinctive shape which provides a much greater area of phosphors (phosphors are what actually produce the light you see by). Result: a far more powerful lamp that can actually effect significant savings per square foot on a new lighting installation.

General Electric introduced this powerful new lamp in 1956. It has still to be matched in lighting power and overall efficiency. Now your customers can benefit from the experience of thousands of users whose installations have proved the profitable way it helps them use light.

For complete information on how your customers can profit with Power Groove lamps, call or see your Large Lamp distributor or write General Electric Company, Large Lamp Department C-233, Nela Park, Cleveland 12, Ohio.

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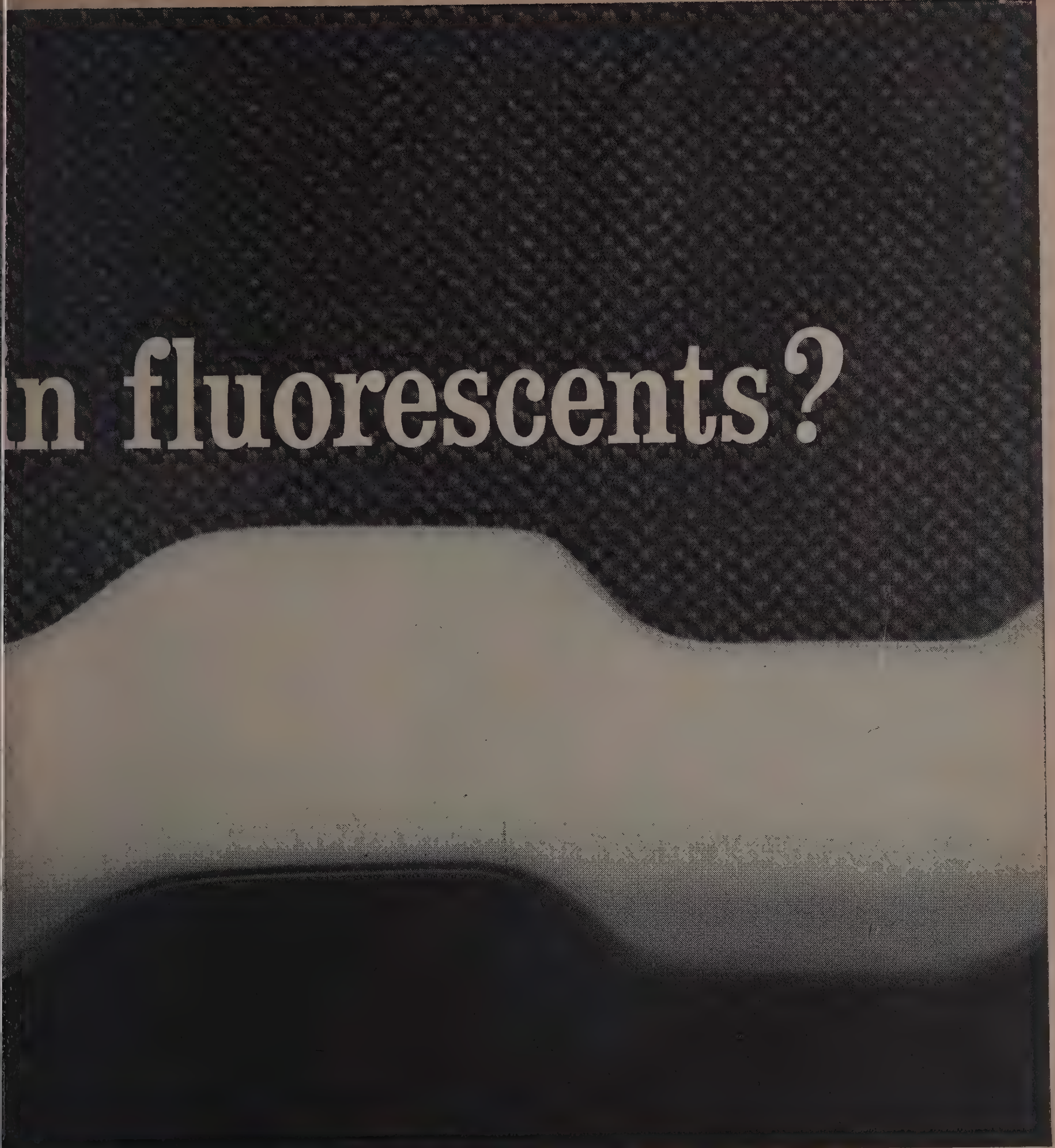
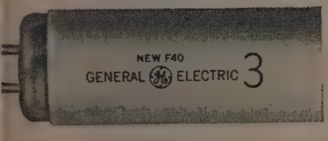
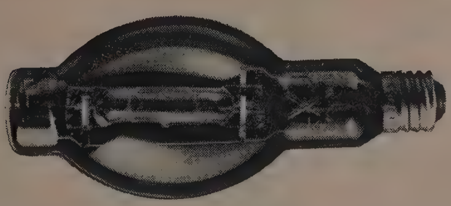
Progress Is Our Most Important Product

GENERAL ELECTRIC

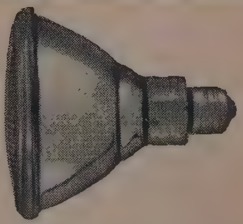




LIGHTING POWER IN STANDARD 40-watt fluorescents is yours from General Electric, too—the New G-E F40 has set new higher light output standards for a mass-produced, nationally distributed lamp and is right now outperforming older designs in plants and offices throughout the country.



STRENGTH WITHOUT DIMINISHED LIGHT: Look at the arc supports of Bonus Mercury lamps—your customers will be able to see for themselves how General Electric engineers designed them for maximum strength, minimum interference with light output. How strong? General Electric is so confident of these simple but rugged arc supports that if there is any structural failure at any time in normal service before the end of rated life a replacement lamp will be supplied at no charge.



BETTER BEAM CONTROL THAT LASTS THE LIFE OF THE LAMP results from the design extras General Electric engineers put into PAR and R spotlights. A special glass bridge holds lead wires in place, maintains better beam control by making sure that filaments stay in proper position over life of lamp.

No. 100. SP, 15 amp. 125-250V., 1 HP 120-240V. AC, normally off momentary contact switch. 1 amp. 125V., ½ amp. 250V. DC.

No. 71. SP, single circuit, lever switch . . . the thinnest 6 amp. "T" 125V—3 amp. 250V switch of its kind—only 15/32" thick.

No. 90. ¾ HP capacity, 15 amp. 125V., 10 amp. 250V. toggle switch. SPST. Designed for AC operation. Also rated 20 amps. 125V AC non-inductive load. Choice of terminals. Also available in double-pole models.

MCGILL INDUSTRY PROVED
QUALITY SAVES
MAINTENANCE COSTS

McGill lamp guards are built to withstand rugged industrial service. Top quality assures a safe, dependable light. Over 100 different types available, including grounded, vaporproof and a variety of types of cages, handles and sizes. Most models available with handles and cords in yellow—the accepted safety color. Use McGill lamp changers for fast, safe replacement of burned out or broken lamps.

Available from your Electrical Wholesaler

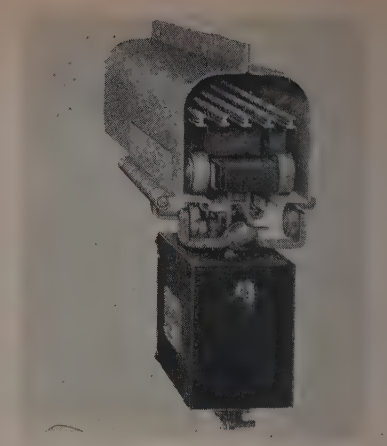
engineered electrical products

MCGILL®

precision needle roller bearings

Write for McGill Electrical Specialties Catalog No. 84

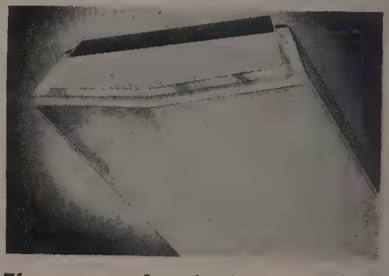
McGill Manufacturing Co., Inc., Electrical Div., 450 N. Campbell St., Valparaiso, Indiana



Busway System **(18)**

New safe steel-enclosed 4- and 5-pole trolley busway electrification systems are designed to provide power and control where the motor load does not exceed 3 hp to 220 volts ac. The systems are made up of standardized units. Copper conductors, mounted on arc-resistant insulators, are enclosed in steel prefabricated housings. Internally track-supported trolleys, either fusible or non-fusible, with all current-carrying parts totally within the track housing, act as power take-offs at any point along the track run. By means of parallel runs, either horizontally or vertically, any number of conductors can be obtained. Literature is available.

Feedrail Corp., 125 Barclay St., New York 7, N. Y.



Fluorescent Luminaire **(19)**

New refracting "Photometric IV" lighting unit is designed for two, four or eight 4-ft rapid-start fluorescent lamps. The 4-ft luminaires are built for two or four 40-watt lamps; 8-ft units use four or eight lamps. The 8-ft units are basically two 4-ft units in tandem. Junctions between the luminaires used in continuous rows are smooth. Body depth is 4⅜ in. Units are available for close-ceiling or stem mounting. It has a sliding-clamp hanger arrangement.

Wakefield Lighting Div., Wakefield Corp., Vermilion, Ohio

Cable Kit (20)

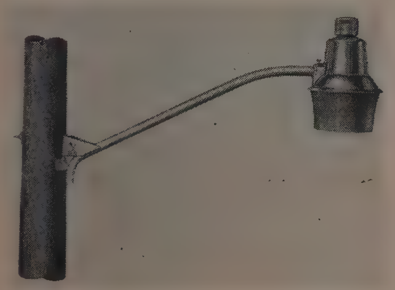
Three tools for installing electrical cable have been included in a new cable installing kit. Supplied in a steel case with carrying handle, kit contains cable cutter, stripper and cable bender. Cable bender will bend up to 750 MCM cable and can be used in or out of the cable enclosure. Cable stripper is a combination tool for cutting, slitting and stripping insulation from cable. Cable cutter cuts up to 1000 MCM copper or aluminum cable.

Thomas & Betts Co., Inc., Elizabeth, N. J.

Wall Plates (21)

Narrow wall plates are now available in Chrome-X (stainless steel) to supplement the regular plastic line. They are designed for use in narrow partitions, marine wiring or any location where standard size wall plates are not practical. Available in three types: for one tumbler switch, one Despard or two Despard devices. All plates have a curved edge with $\frac{1}{16}$ radius. Mounting straps are available for both Despard type plates.

Pass and Seymour, Inc., Solvay Station, Syracuse 9, N. Y.



Luminaire (22)

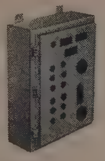
A mercury luminaire, called Suburbanaire, is designed specifically to meet the requirements of the expanding Dusk-to-Dawn program. Available with either a borosilicate glassware refractor rated through 250 watts, or an acrylic plastic refractor rated through 175 watts, the one-piece head and reflector feature a spring-loaded V-band that can accommodate the differences in thermal expansion and contraction of the glassware and plastic. Unit is available in a choice of seven light patterns to provide precise lighting control.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, Wis.

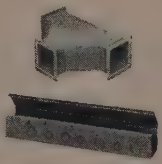
COURTESY OF DETROIT HISTORICAL MUSEUM

Why not?

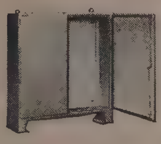
True, it burns faster . . . but you also get more light. And this might be just the result you need. That's why we try different approaches to shed light on unusual electrical enclosure problems. So, you can rely on prompt answers and competitive quotes from Keystone—on all types of custom boxes, cabinets and enclosures for any application. Just send us a sketch or blueprint, outlining your particular requirements. We always keep a light on.



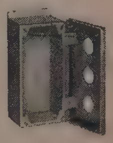
Custom Cabinets



Wireways & Fittings



Nema 12 Enclosures



Pushbutton Enclosures

KEYSTONE
MANUFACTURING COMPANY
DIVISION OF AVIS INDUSTRIAL CORPORATION
23330 Sherwood Avenue • Warren, Michigan

TOMIC'S
Inside
Story

begins
here...

For the first time—you can rely on
ONE ALL-PURPOSE RAINTIGHT FITTING
wherever Thinwall is used!

SEMI-AUTOMATIC! No tools required. Just *TAP* or *PUSH* on.

ACCURATE! When "Tap-Ons" are used the job has to be right. Errors cannot be covered up. Easy to inspect.

VERSATILE! Permits fast, easy changes from EMT to rigid conduit—even Greenfield—without special adaptors of any kind. Ideal for long runs, saddle bends, corners, cramped locations. Available in ½" and ¾" sizes.

VIBRATION-PROOF! Patented stainless steel locking ring in connector grips tubing securely for positive, vibration-proof ground. *All parts screw together, can't pull or shake loose.*

Raintight Connector

RAINTIGHT! Tomic Tap-On All-Purpose Fittings can be used outdoors or in concrete slabs, anywhere EMT is used.

INSULATED AND BUSHED! Bushing provides *extra* protection against shorts. Smoothly rounded surfaces can't snag fishtape or fray wire. Surpasses insulation requirements of National Elec. Code, Para. 373-6 (b)

For Fast, Positive Connections . . .

Just "TAP-ON" . . . or "PUSH-ON"

TOMIC also makes a line of other Connectors and Couplings for EMT and Flexible Metallic Tubing, Fixture Hangers, Clips, Cable Connectors and similar Fittings

WRITE for Catalog C-11 for the entire cost-cutting Tomic Line!

tomic ELECTRICAL FITTINGS
TOMIC SALES & ENGINEERING CO.
20000 Sherwood Ave. • Detroit 34, Mich.

Breaker (23)

A new 100-amp, 120/240-volt ac, double pole Safetybreaker, Cat. No. CH2100, has been announced. This common trip, plug-in type device features a special bolt-down design which allows breaker to be fastened to panel at any breaker position through use of a screwdriver. The CH2100 may be used as a main disconnect or for sub-feeding additional heating and lighting panels. It is also available as a 2-pole, 90-amp, 120/240-volt ac device, Cat. No. CH290. NEMA 1 surface or flush mounted, and raintight enclosures are available.

Cutler-Hammer, 315 *North* 12*th St., Milwaukee* 1, *Wis.*

Cables (24)

A standard series of underground residential distribution (URD) cables has been announced. Providing a full range of 5-kv and 15-kv rated single-phase primary cables, the URD line offers either aluminum or copper conductors and either polyethylene or butyl-base insulation. Over-all cable design is in accordance with IPCEA standards. The series utilizes concentrically applied copper wires or lead sheath over an insulated conductor to afford ground return and electrostatic shielding.

Rome Cable Division of Alcoa, Rome, N. Y.

Winch (25)

A new portable gasoline-powered winch, called the Ensley Power Winch, has been announced. Complete unit, mounted on three wheels with balloon tires, is easily wheeled up stairs, through doorways and tunnels and around corners. It is approximately 2 ft wide, 4 ft long and 3 ft high. Weighing 340 lbs, the winch will handle loads up to 4,000 lbs. Anchorage to floor, wall, sidewalk or pavement is provided by two suction cups under vacuum pressure. Brochure is available.

Power Winch Div., Ideas Inc., 214 *Ivinson, Laramie, Wyo.*

Light Controller (26)

A new electronic light controller for home, office and institutional use, the Luxtrol Light Control SBD 500, which dims and brightens incandescent lighting by the turn of a small dial, is now available. Designed for use with up to 500 watts of incandescent lighting in chandeliers, lamps and other fixtures, it eliminates the need for an on-off switch. It can be installed in most standard 2½-in. deep wallboxes and operates on a single circuit. It is not intended for use with fluorescent lighting.

Superior Electric Co., Bristol, Conn.

Ballast (27)

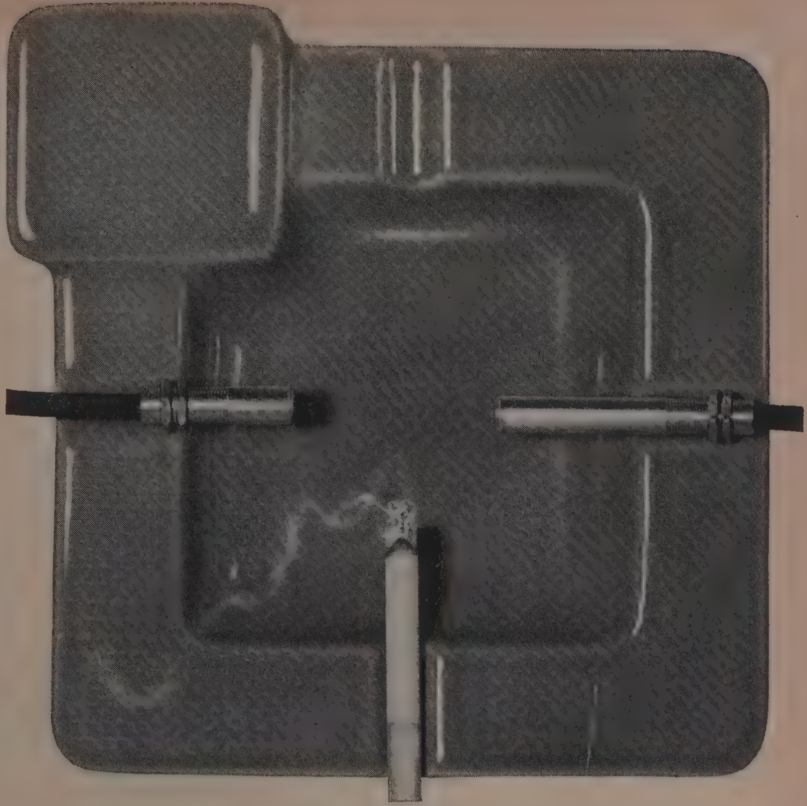
A new outdoor non-weatherproof multilamp 800 ma rapid start ballast is available. Ballast can be utilized for any 2-lamp combination of 48, 42, 36, 24T12 or 1-lamp 96, 84, 72, 64, 60, 48T12. Unit is UL listed and CBM certified for 1-96T12 or 1-72T12 lamps. Ballast should be installed within 1-in. of a metal reflector.

Sola Electric Co., Elk Grove Village, Ill.

Ammeter (28)

A miniature recording ammeter, called the Amprobe Recorder Model AA-2, provides users with a permanent record of alternating current up to 250 amps, on a paper tape 2½ in. wide by 30 ft long. With the chart paper removed, the instrument can be used as either a portable meter or, with an adapter, as a standard panel meter. A split-core transformer, which is supplied with the recorder, senses currents by induction. In operation, the transformer is plugged into the instrument and its jaws are snapped around the conductor for which a current reading is desired. A 4-position switch on the transformer permits selection of one of four current ranges: 0/5/25/100/250 amps ac. Literature is available.

Amprobe Instrument Corp., 630 Merrick Road, Lynbrook, N. Y.



New micro-miniature units . . . latest additions to General Electric's full line of photoelectric controls

New micro-miniature light sources and receivers add new versatility to General Electric's full line of photoelectric controls and sensing devices. Measuring only ⅜-inch in diameter, the light source and receiver are designed for use where space is a problem. Easily installed, and requiring no focusing, they will deliver exceptional performance for many applications. The light source is rated up to 20,000 hours; the solid-state receiver delivers almost infinite electrical life.

General Electric offers a full line of photoelectric devices and systems for every job; also voltage-, or resistance-sensitive relays, a smoke-density indicator, radiant-heat detector, and electronic timers. For complete information, write for General Electric's new "Photoelectric Control" bulletin, GEA-6822, General Electric Company, Schenectady, New York. 793-07

Specialty Control Department, Waynesboro, Virginia

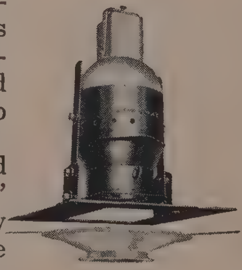
Progress Is Our Most Important Product

GENERAL ELECTRIC

Lighting News AT THE INTERNATIONAL BUILDING

...another installation by KLIEGL

San Francisco's newest skyscraper incorporates much that is new and distinctive. In the 24-foot high entrance lobby, for example, architects Anshen & Allen called for "even lighting at floor, with no light on the walls." The effect was accomplished with Kliegl "Adjustable Beam" Downlights.



When lighting must be designed to exacting standards, discriminating designers and architects turn to Kliegl. Over a half-century of experience in optics and reflector design is built into every Kliegl installation.

The same know-how acquired in solving thousands of "hard" lighting problems is readily available for *your* project—large or small, conventional or unusual. Your call to Kliegl can make a big difference in long-term satisfaction and over-all economy.

Write for your Kliegl lighting survey

Our lighting engineers will be pleased to assist in the planning of any installation. Full details on request, without obligation.

lighting

KLIEGL BROS.
ORIGINATORS AND MANUFACTURERS OF KLIEGLIGHTS
321 W. 50th ST., NEW YORK 19, N. Y.
Telephone: Area Code 212, COlumbus 5-0130

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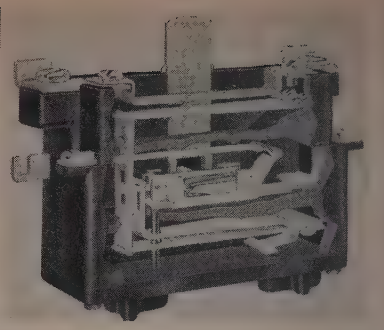


Overload Protection (29)

Motors are protected even though temperature surrounding relay differs or is variable from that surrounding motor. Responding only to motor current rather than temperature fluctuation, trip time remains constant between −20°F and +170°F. Unit features independent trip time, manual or automatic reset, standard or quick trip heaters, compact design and is resistant to heat and impact. Available for starter sizes 0 through 4, relays can also be furnished for panel mounting, in separate enclosures, or as a third overload relay kit.

Furnas Electric Co., 1067 *McKee St., Batavia, Ill.*

Voltage Stabilizer (30)

A line of automatic voltage stabilizing transformers has been announced. Line voltage variations as high as 20% above normal and 20% below normal are stabilized to within plus or minus 1% of a fixed voltage on the output side. Response to line voltage fluctuations is instantaneous. Stabilizers are available in sizes up to and including 100 kva, single phase and 3-phase and in all standard or non-standard line voltage ratings to 600 volts.

Marcus Transformer Co., Inc., Rahway, N. J.

Cable (31)

"Xtra-flex," a new portable cable, has been introduced. Insulated and sheathed of special polyvinylchloride compound, it has a high dielectric strength and is flame, moisture, abrasion, oil, acid and alkali resistant. The cable, colored yellow, is available in the following sizes: two conductor flat type "W" and "G" cable, sizes No. 6 through No. 2/0; 2-3-4 conductor portable cords and cables, sizes No. 18 through No. 2; single conductor, sizes No. 8 through No. 500 MGM.

Coleman Cable and Wire Co., 1900 *N. River Road, River Grove, Ill.*

Motor Control (32)

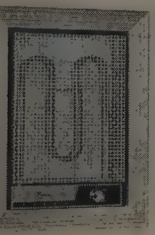
Bulletin 6805 is full magnetic motor starter, totally enclosed within a NEMA I general purpose enclosure of NEMA IV and V. It is designed to provide starting, with low inrush current, of 2- or 3-phase squirrel cage motors which have primary windings in two parts. At least three leads for each winding must be brought outside the motor. This motor starter, when used with these motors, provides across-the-line starting with overload and undervoltage protection. Standard 2- or 3-phase squirrel cage dual voltage motors have windings that can be adapted to this method of starting.

Monitor Controller Div., Atlee Corp., 99 Grove St., Rockland, Mass.

Fitting (33)

The No. 659 combination coupling saves time in connecting ¾ in. EMT to ¾ in. Greenfield (flexible steel conduit). All screws that tighten into EMT are case hardened and staked in the "up" position. Staking permits insertion of tubing without added operation of backing off the screws. Other combination couplings ranging in size from ½ in. to 1 in. are available for EMT to rigid and rigid to Greenfield. Literature is available.

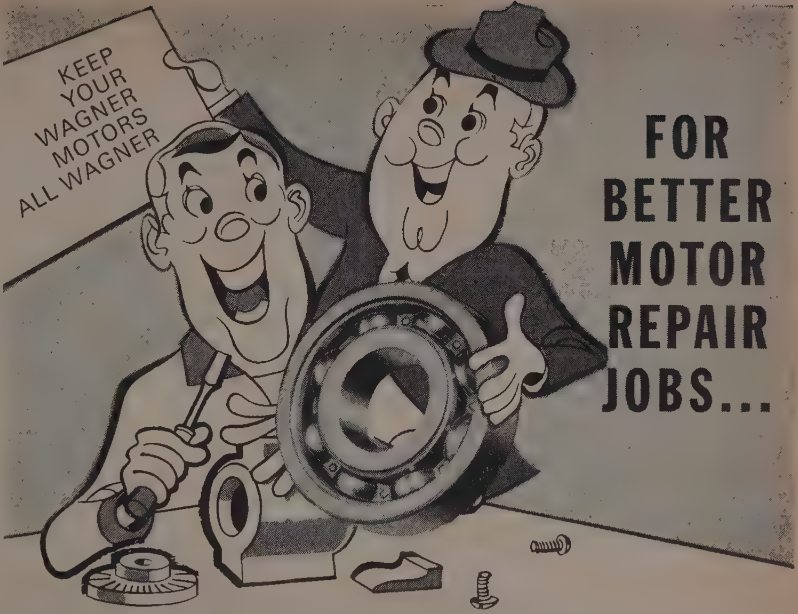
Allen-Stevens Conduit Fittings Corp., 33-53 62nd St., Woodside, N. Y.



Wall Heater (34)

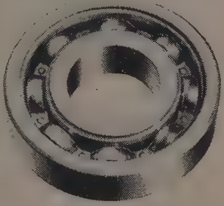
A new radiant wall heater (RW 1211) is for bath, basement and recreation rooms. It can be surface or flush mounted. Heater is thermostatically controlled and provides five heat settings. Tubular heating element is installed behind aluminum grille. Housing may be painted to suit room decor. Dimensions are: 11$\frac{1}{16}$-in. wide, 15$\frac{1}{16}$-in. tall and 2-in. deep. Operating on 120 volts, it consumes 750 watts with an output of 2559 Btu/hr.

Fasco Industries, Inc., Augusta at North Union, Rochester 2, N. Y.

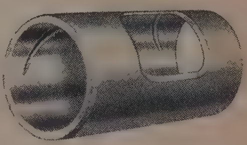

KEEP YOUR WAGNER MOTORS ALL WAGNER
FOR BETTER MOTOR REPAIR JOBS...

USE WAGNER® REPLACEMENT BEARINGS

they fit right and work right every time!



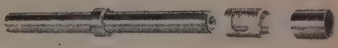
WAGNER BALL BEARINGS are exactly right for the motor in which they are used. Always replace worn-out or damaged bearings with the same high-quality ball bearings used as original components. You're assured a better job in less time with complete customer satisfaction.



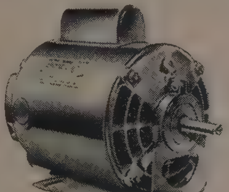
WAGNER SLEEVE BEARINGS are precision bored to size so they fit right every time. Exact duplicates of the originals used in Wagner® Motors, they are steel-backed, 85% tin babbitt-lined . . . won't seize or grab, and won't corrode. Fine quality always makes your job better.

SLEEVE BEARING REPLACEMENT IS EASY WITH THE WAGNER BEARING TOOL

. . . one simple operation does the job.



You drive out the worn sleeve and install the new Wagner sleeve bearing, quickly and easily. No pounding or reaming, yet you get perfect alignment every time.



BECOME KNOWN AS A SMART BUSINESSMAN BY SELLING NEW WAGNER MOTORS. There are times when it is not worthwhile to repair a motor . . . either for you or your customer. This is the time to sell a new Wagner Motor as a replacement. You make full profit on every motor you sell plus saving valuable shop time and labor working on an impossible repair job. You will also be able to give your customer over-the-counter service. See your Wagner distributor and learn how you can make additional profits on motor replacement sales.

Wagner Electric Corporation
6413 PLYMOUTH AVENUE, ST. LOUIS 33, MO., U.S.A.
Manufacturers of LOCKHEED® Products
OVER 850 AUTHORIZED SERVICE STATIONS OR PARTS DISTRIBUTORS

WR62-4

MOTORS • BEARINGS • STANDARD ROTORS • BRUSHES • CAPACITORS • COMMUTATORS

THE BENDING IS FAST AND EASY

With Republic GALVITE® *Rigid Steel Conduit,* you save time and money—eliminate delays caused by bending problems.

There are no troublesome hard spots in this hot dip galvanized conduit. Only the finest steel is used. Made in Republic's own mills, this steel is uniformly soft and easy to bend.

Threads are clean, sharp, free-running, and zinc protected. Wire pulling and pushing are easier because Galvite Conduit has a smooth inside lacquer finish. And, there are no internal burrs or coating projections.

Republic also offers baked-on black enamel ENAMELITE® Rigid Steel Conduit. Both types are furnished to ASA and Federal Specifications, meet electrical codes, and are listed by Underwriters Laboratories, Inc.

For complete information about Republic Rigid Steel Conduit, call your nearest Republic representative or mail the coupon below.

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STEEL AND TUBES DIVISION
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Compatibility and strength characterize raceways made of Galvanized Steel

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STEEL AND TUBES DIVISION • DEPT. A-4152
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Please send additional information on the installation advantages of Republic Rigid Steel Conduit.

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They tell me you don't believe advertising claims anymore

So we won't make any. We'll just give you a couple of facts and let you draw your own conclusions.

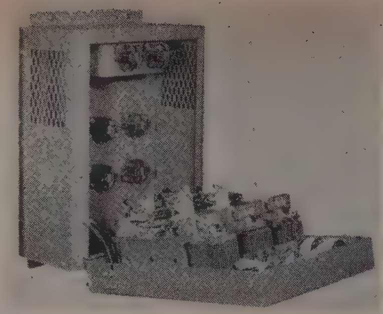
It's a fact! Municipalities carefully investigate the various types of fire alarm systems before they make a choice. They want assurance that the system will be efficient, reliable and economical.

It's a fact! The overwhelming majority of communities that have fire alarm systems have chosen Gamewell. Next time you pass one of those familiar red boxes on the street in your community, stop for a second and take a look. Chances are you'll see the name Gamewell.

Don't you think the reasons Gamewell fire alarm systems are the overwhelming choice of municipalities hold true for industrial systems, too? In fire protection, experience has proved Gamewell knows its profession. Gamewell Flexalarm Systems for industry provide for completely automatic fire detection and alarm sounding, plus interconnection with other services — such as sprinklers.

Get all the facts about Flexalarm Systems. Write The Gamewell Company, Dept. 1405, Newton Upper Falls 64, Mass. A Subsidiary of E. W. Bliss Company.

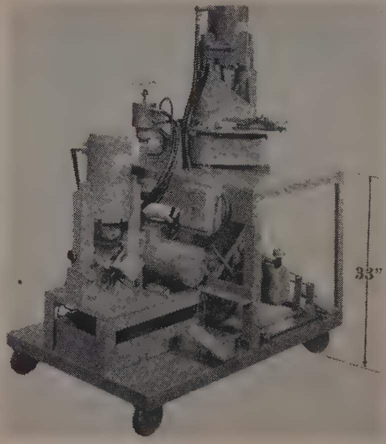
BLISS Gamewell®
FIRST... WHEN SECONDS COUNT



Static Starter **(35)**

A new static starter for motors, utilizing silicon-controlled rectifier as the main power switch, has been developed. The "Trinistor" device, like the silicon cell of which it is a derivative, blocks conduction in the reverse direction. It provides complete control of conduction in the forward direction. By proper arrangement of units, it is possible to have total control of a 3-phase inductive or resistive load. Standardized starter designs are applicable to 20-hp motors "across the line," and up to 75-hp motors with reduced voltage. Firing and switching circuits are contained in a standard wall mounted NEMA-1 enclosure. A 220-volt, 3-phase static starter measures 16 by 14 by 8 in.

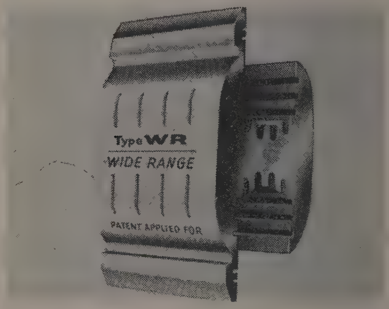
Westinghouse Electric Corp., General Purpose Control Dept., Buffalo, N. Y.



Maintenance Shop **(36)**

A new portable maintenance shop has been announced. Three hydraulic fabricating machines have been made into a mobile unit and is called "Portable Maintenance Fabricator." The three machines are: a shear, coper-notcher-bender and a punch. Parts can be mitred, coped, notched and bent or formed. The capacity of shear permits 4 by 4 by ¼ angle and 5/16 by 6 in. flats to be cut off. Portable punching units from 5 to 30 ton capacities are available. Portable unit enables maintenance department to work at the location when and where it is needed.

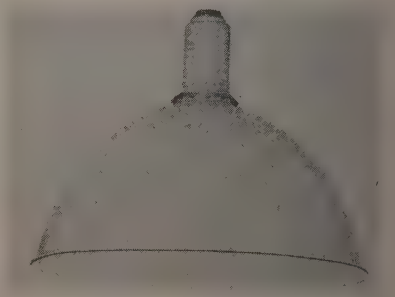
W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill.



Connector **(37)**

A new wide range aluminum reversible compression connector has been announced. Every possible combination of conductors from six solid through 4/0 ACSR can be made with 13 sizes. Connector can be compressed mechanically or hydraulically with tools and dies now in use. Longitudinal ribs on surfaces of grooves deform around conductor when compressed. Full length tabs have been designed to fold automatically into grooves during compression. Data on Type WR connectors is available.

Jasper Blackburn Corp., 1525 Woodson Road, St. Louis 14, Mo.



Reflector **(38)**

A new 1000-watt RLM high bay mercury lamp reflector is designed to provide uniform illumination on vertical as well as horizontal surfaces, utilizing mercury vapor and incandescent lamps. Reflectors are of white porcelain enamel, spread type and ventilated. They have drop shield protection. Reflectors attach to threaded hoods which are adapted for "Easy-Tach" disconnecting sockets.

Quadrangle Mfg. Co., 32 S. Peoria St., Chicago 7, Ill.

FOR ECONOMY MINDED BUYERS OF LIGHTING EQUIPMENT

Sylvania's New Stylus Series provides Quality Lighting at Budget Prices

Here's a new Sylvania Fixture Series that has gained tremendous acceptance because it fills the lighting requirements so perfectly for schools, offices and stores.

Featuring a wraparound plastic one-piece lens shielding, The Stylus provides high lighting efficiency with comfort; shallow, modern styling; neat, handsome appearance; and simplified installation and maintenance features.

Sylvania's high-quality product standards of rugged construction, long-lasting finish, CBM ballasts, and guaranteed performance have been maintained. Yet The Stylus carries an exceptionally modest price tag.

The Stylus provides eye comfort with a dual prismatic low-brightness lens which reduces contrast by directing some light to the ceiling.

Maintenance is made easier through the use of a bead chain retainer which holds the lens during cleaning or re-lamping.

When budget lighting is required, see your Sylvania distributor or write to Sylvania for complete information on The Stylus Series.

Here are some details:

Ordering No.	Length	Width	Depth	Lamps
W-2404	4′	11″	3½″	2-40 Watt Rapid Start
W-4408	8′	11″	3½″	4-40 Watt Rapid Start
W-4404	4′	16½″	3½″	4-40 Watt Rapid Start

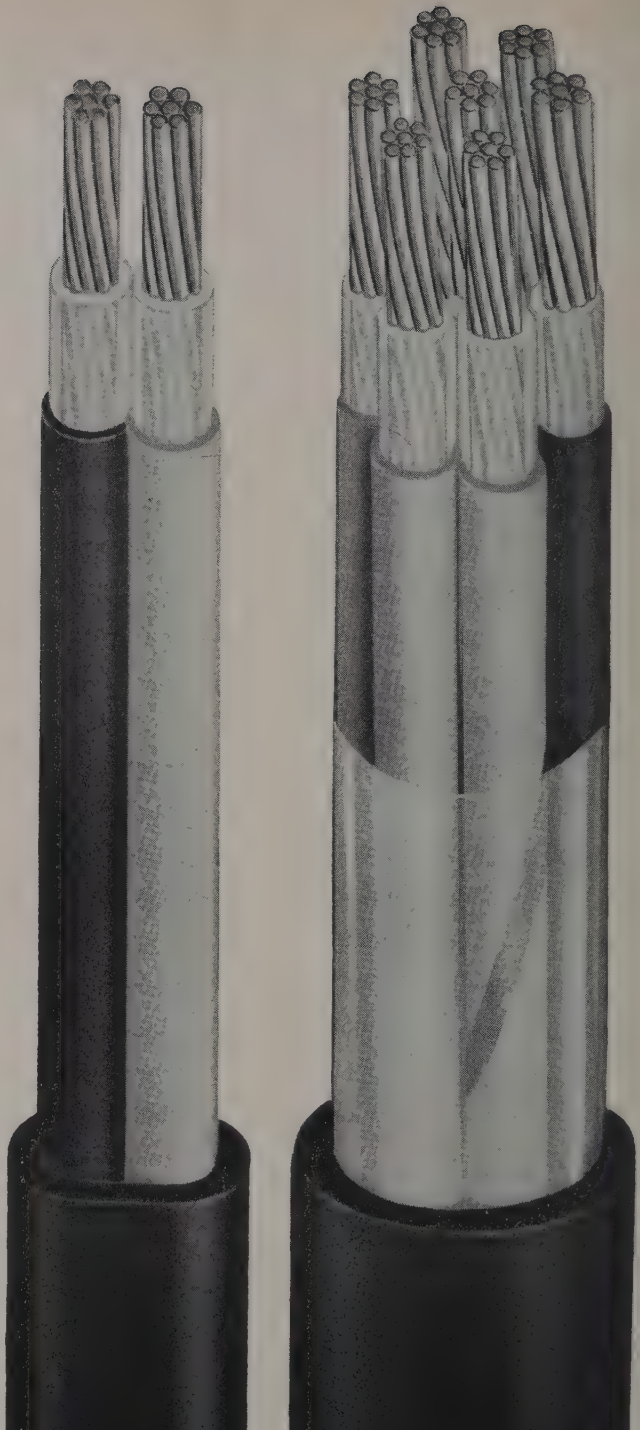
Because of the popularity of The Stylus, these fixtures are being manufactured continually. Therefore fast delivery can usually be assured. Check your Sylvania distributor for service information.

LIGHTING FIXTURES BY

SYLVANIA

GENERAL TELEPHONE & ELECTRONICS

SYLVANIA LIGHTING PRODUCTS
A Division of SYLVANIA ELECTRIC PRODUCTS INC.
One 48th Street, Wheeling, West Virginia



any way you want them

ROME DELIVERS FAST Whether with two conductors or 37 conductors—or any number in between—these **standard** Rome control cables are often delivered right off the shelf. They're Rome CT cables: smaller, lighter, more flexible than rubber types, ideal for most control cable jobs. ■ Available quickly in No. 10 or No. 12 AWG, Type CT-B (AC or DC to 600 V) and Type CT-C (AC or DC to 1000 V) cables are insulated with polyethylene and jacketed with Synthinol*, assuring high dielectric strength and resistance to moisture, acids, alkalis, oils, heat, flame and mechanical abuse. You can install them in open air, ducts, conduit, tray or trough . . . or even bury them directly in the earth. Both types comply with the requirements of IPCEA-NEMA standards. ■ A 4-page booklet will give you all the facts: just write to Rome Cable Division of Alcoa, Dept. 7-62. Rome, New York.

*Registered trade mark for Rome's specially-formulated polyvinyl chloride.

ALCOA
ROME CABLE
DIVISION

Two of Rome's standard control cables: two-conductor and seven-conductor #12 AWG 600-Volt Type CT-B.

That's a bold statement to be sure. But Allen-Bradley ulletin 800T "quality" oiltight control units—operating ssemblies, contact blocks, mountings and accessories—re built to stand up under the toughest conditions, longer han you'd ever think possible. And this longer, trouble ree life naturally means less service attention. More mportant, not a minute of production time to be wasted. ne reason for this is that A-B control units and enclo-ures are positively oiltight. It is impossible for cutting fluids, oils, or grit to foul the contacts. Also, because they're silver, the contacts never need maintenance.

What more could you ask for than good looks and long reliable operating life—plus a variety of combinations that run into the thousands—everything to satisfy the most exacting requirements. So be sure you have all the details contained in Publication 6090. Please write: Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wisconsin. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

21-06-2

LLEN-BRADLEY

Member of NEMA

QUALITY
MOTOR CONTROL

BULLETIN 712 Combination Starter

Maximum ratings for this Size 1 starter are: 7½ hp, 220 v.; 10 hp, 440-550 v. Available fusible, as shown, or non-fusible.

NO OTHER...
Combination Starter in Your Plant Can Give You All This!

Series K Combination Starters are piling up a record of performance, the likes of which industry has never seen before. And why not! Allen-Bradley combination starters combine more advantages in the best looking enclosures ever.

Let's start with *safety* for men and machines. The cabinet door cannot be opened unless the three-position operating handle is in the OPEN position, where the disconnect is off. The handle as well as the cabinet door can be padlocked to prevent tampering. And don't forget, the familiar A-B white interior makes it easier to see what you're doing.

Then there's *long life*. The improved solenoid, one-moving-part construction, is so simple, nothing can go wrong. The pressure molded coil is more than a match for any harmful atmosphere, and all but malicious abuse. The precision, hot molded arc hood greatly increases the interrupting capacity. Full rated loads are switched with ease, and there's ample reserve for emergencies.

Now, let's take *maintenance*. The weld-resistant, cadmium oxide silver contacts *never* need service attention. A permanent air gap eliminates any chance of magnetic "sticking." New overload relays are *honestly* trip-free and tamperproof.

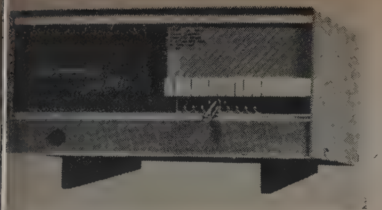
And, there's an opportunity to save time on installation. A-B combination starters are easier to wire than a plain starter and a separate disconnect switch. There are fewer connections to make. So, why not get the complete details contained in Publication 6100, today. Please write: Allen-Bradley Co., 1316 South Second Street, Milwaukee 4, Wisconsin.

20-06-2

ALLEN-BRADLEY

Member of NEMA

QUALITY MOTOR CONTROL



Paging System **(39)**

A 10-call paging system, called the Lokette, is designed to locate key personnel in small offices, stores, banks or warehouses. To page a person away from his desk, the switchboard operator moves a switch on the Lokette to position opposite his name, and his individual code is sounded on chimes, bells, horns or other signals located throughout the plant or store. System pages continuously at 120 beats-per-minute until switched off by operator when page is answered. Unit, 7½ by 7¾ by 3½, is designed to sit on any switchboard.

Edwards Co., Inc., Norwalk, Conn.

Ditcher **(40)**

The new Model W-1 Pow-R ditcher digs up to 60 in. deep. It features all-hydraulic drive, in both digging and transporting speeds. Available on either crawler tracks or rubber tires, unit is powered by a Wisconsin 12½-hp AGND engine. Special ejector paddles allow dirt to be deposited on both sides of ditch rather than thrown over a wide area. W-1 end boom idler is equipped with a Timken bearing. Boom is raised and lowered hydraulically.

Vermeer Manufacturing Co., Pella, Iowa

Stand-by Systems **(41)**

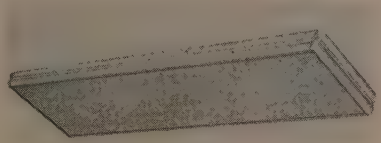
A new line of static stand-by ac electric power systems has been introduced for industrial and business applications. Systems produce nominal 115-volt ac electricity by instantaneous conversion of dc from storage batteries to assure continuous operation of electrical equipment despite overloads, fluctuations or interruptions of normal power supplies. Three basic systems will be available—continuous, auctioneer and transfer. These include 16 different models, rated from 2.5 to 45 kva, having 120-volt, single phase and 120/208-volt 3-phase, 60-cycle ac outputs.

Exide Industrial Marketing Div., Electric Storage Battery Co., Rising Sun and Adams Aves., Philadelphia 20, Pa.

Plates and Boxes **(42)**

A new series of flush plates and enclosures which protect personnel, elements, and wiring of Bulletin 100, NEMA 1, panel-mounting pushbuttons has been announced. Steel flush plates adapt panel-mounting pushbuttons to panel, machine cavity, or wall mounting. Pushbutton units mount on flush plate. They are designed for either vertical or horizontal mounting. Eight different plates are available to accommodate from one to eight units. Wall boxes protect pushbutton contact blocks for plaster or tile wall applications. Pushbutton units are mounted on flush plate. Five different wall boxes are available to accommodate from one to five units.

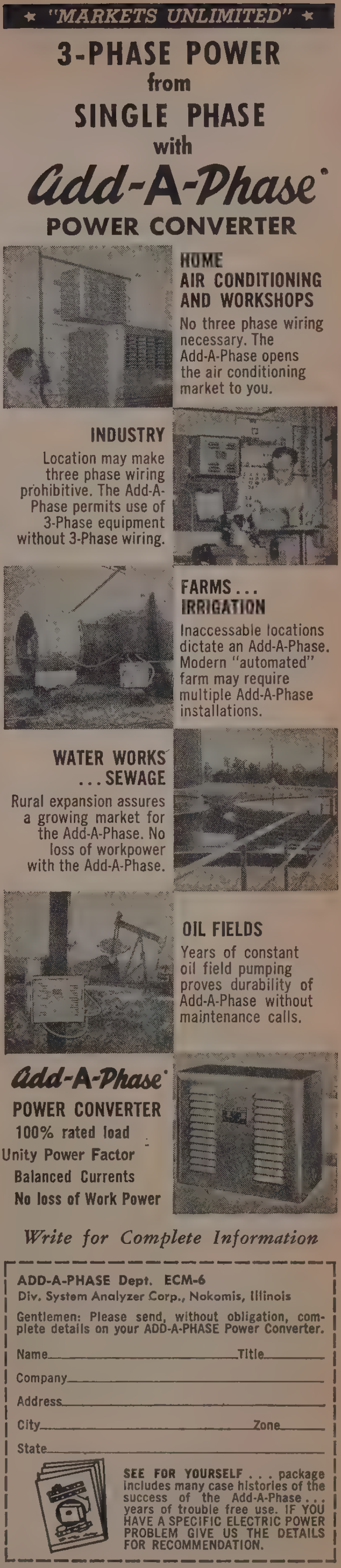
Clark Controller Co., 1146 *East* 152*d St., Cleveland* 10, *Ohio*



Lighting Fixtures **(43)**

New series of fluorescent lighting fixtures has been developed. Called "Flightron," these are all-white, all-plastic shielded fixtures. Units may be surface or pendant mounted, singly or in continuous row, for 2- or 4-lamp rapid start or slimline operation. A selection of light control mediums is available: "Sunlux" clear plastic lens panel for low brightness control; "Opalux" translucent plastic patterned panels for uniform diffusion and miniature-celled plastic louver for increased downward lighting. Full length hook-on hinging arrangement allows diffuser to be removed or opened from either side.

Sunbeam Lighting Co., 777 *East* 14*th Place, Los Angeles* 21, *Calif.*



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3-PHASE POWER
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SINGLE PHASE
with
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POWER CONVERTER

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AIR CONDITIONING AND WORKSHOPS
No three phase wiring necessary. The Add-A-Phase opens the air conditioning market to you.

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Location may make three phase wiring prohibitive. The Add-A-Phase permits use of 3-Phase equipment without 3-Phase wiring.

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IRRIGATION
Inaccessable locations dictate an Add-A-Phase. Modern "automated" farm may require multiple Add-A-Phase installations.

WATER WORKS
. . . SEWAGE
Rural expansion assures a growing market for the Add-A-Phase. No loss of workpower with the Add-A-Phase.

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Years of constant oil field pumping proves durability of Add-A-Phase without maintenance calls.

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100% rated load
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ADD-A-PHASE Dept. ECM-6
Div. System Analyzer Corp., Nokomis, Illinois

Gentlemen: Please send, without obligation, complete details on your ADD-A-PHASE Power Converter.

Name__________ Title__________
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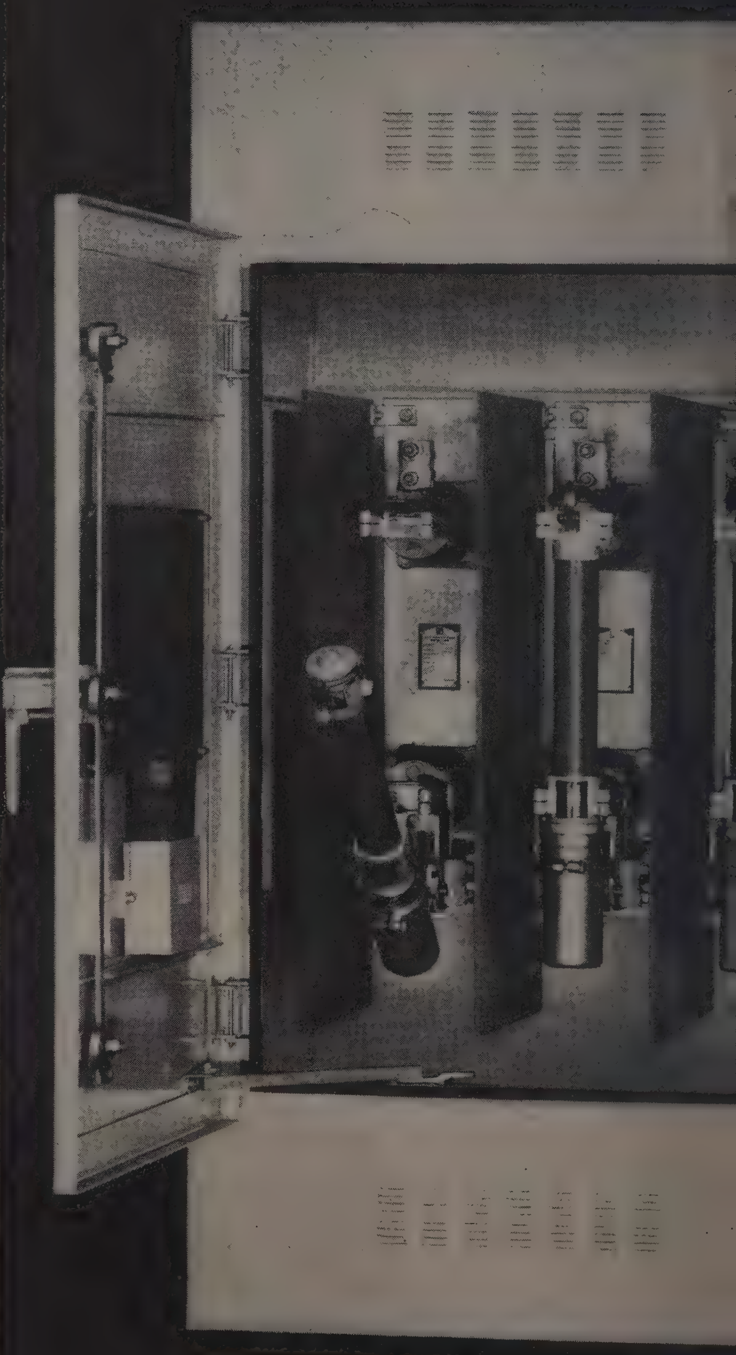
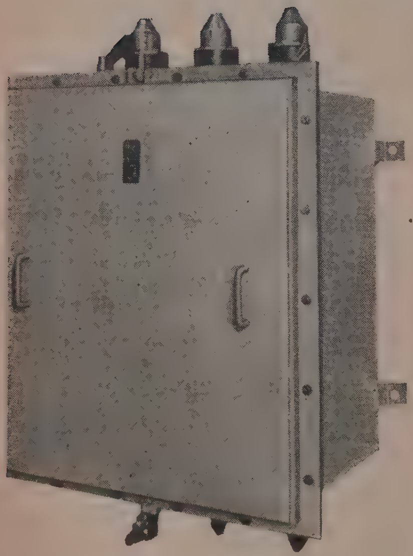
City__________ Zone__________
State__________

SEE FOR YOURSELF . . . package includes many case histories of the success of the Add-A-Phase . . . years of trouble free use. IF YOU HAVE A SPECIFIC ELECTRIC POWER PROBLEM GIVE US THE DETAILS FOR RECOMMENDATION.

Who ever heard of hanging 500,000 kva on a wall?





▲
Submersible style for use in basements or vaults where flooding is a possibility.

►
Indoor-outdoor style for general application where there is no possibility of flooding.

Do it with S&C's new line of high-voltage metalclad fuses for wall mounting

Here is a steel-enclosed fuse that gives you economical and fully adequate high-voltage fault protection for small loads:

1. *At service entrances;*
2. *On transformer primaries;*
3. *At underground sectionalizing points.*

S&C's new line of metalclad fuses combines economy with high fault interrupting capability. Their compactness permits wall mounting, eliminating the floor area requirements of conventional free standing metalclad switchgear. And much less room height is needed.

These fuses are especially suited to applications that justify fault protection *only*—applications where infrequent load switching (and isolation for rare fuse replacement) may be done elsewhere.

To permit you to tailor the new S&C Metalclad Fuse—Type SM to your particular requirements, a complete selection of features and ratings is available:

- Indoor Style, Indoor-Outdoor Style, or Submersible Style
- 4.8 kv or 14.4 kv
- 200E or 400E continuous amperes
- Cable entrance by knockout, flange-mounted pothead (1/C or 3/C), or integral pothead (1/C)
- 45,000 kva to 500,000 kva fault interrupting, in convenient steps

For further information, call your nearest S&C Sales Office. Consult the Yellow Pages under "Electrical Equipment" for the telephone number and address in all principal cities.

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Specialists in High Voltage Circuit Interruption since 1911

S&C

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preferred by linemen
... electricians

The name Klein on leather goods is known and preferred by linemen and electricians everywhere. Klein tool belts, safety straps, pouches and pockets represent the highest in quality, the safest in design and construction.

In safety straps, Klein-Kord was the first specially woven fabric strap designed to permit the use of a tongue-type buckle without risk of slitting or ripping, even under severe strain.

Now Nylon Klein-Kord safety straps are the newest Klein development offering maximum safety with maximum flexibility. These are the only nylon straps designed to meet the tests given in Edison Electric Institute Report AP-2.

Free Tool Guide
A copy of the new Klein Pocket Tool Guide will be sent on request.

Foreign Distributor:
International Standard Electric Corp., N. Y.

Mathias KLEIN & Sons
Established 1857
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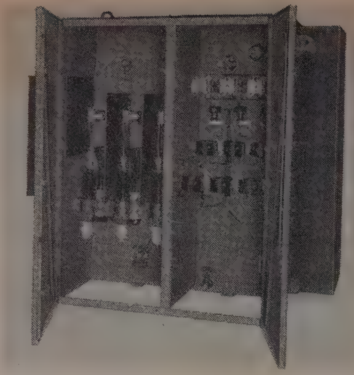


Transformers (44)

Introduction of a complete line of Safe/Tran single-ended pad mounted transformers 112½ through 2000 kva, 3-phase, 15 kv and below has been announced. Line is designed specifically to meet utilities' requirements for a substation for supplying concentrated industrial and commercial loads in outlying urban areas to shopping centers, schools, apartment houses, etc. All transformers in the line are designed to withstand shock of a full short circuit across the secondary. "Playground-safe" U-type coolers offer an uncluttered appearance.

Allis-Chalmers Manufacturing Co., Milwaukee 1, *Wis.*

Vaportight Lighting (45)

New vaportight lighting equipment, Series 43-100, known as "Designer Styling," has been introduced. Non-corrosive vaportight construction makes these units suited for industrial lighting applications. Shallow threaded white opal diffusing globe compresses gasket to backplate for complete vaportight seal. Fixture will accommodate up to two 100-watt A-21 medium base incandescent lamps. Cast aluminum guard provides protection to diffuser in either vertical or horizontal mounting positions. Fixture is listed by UL as "enclosed and gasketed."

McPhilben Mfg. Co., 1329 *Willoughby Ave., Brooklyn* 37, *N. Y.*

Switches (46)

New break-glass switches, surface and flush types, for emergency safety controls are available. They feature all aluminum construction with a red and aluminum finish. Surface types are furnished in a NEMA 2 drip-proof enclosure. Cover plate can be inverted for top or bottom conduit entrance. Single pole, double throw construction is standard. Same switch is suitable for controlling 2-wire devices such as motor starters and solenoid valves, and 3-wire devices such as mechanically held remote control switches. Switches are listed for 250 volts maximum. Interrupting capacity: 5 amps at 250 volts ac; 10 amps at 125 volts ac. Bulletin 124 is available.

Automatic Switch Co., Florham Park, N. J.

Electric Heating (47)

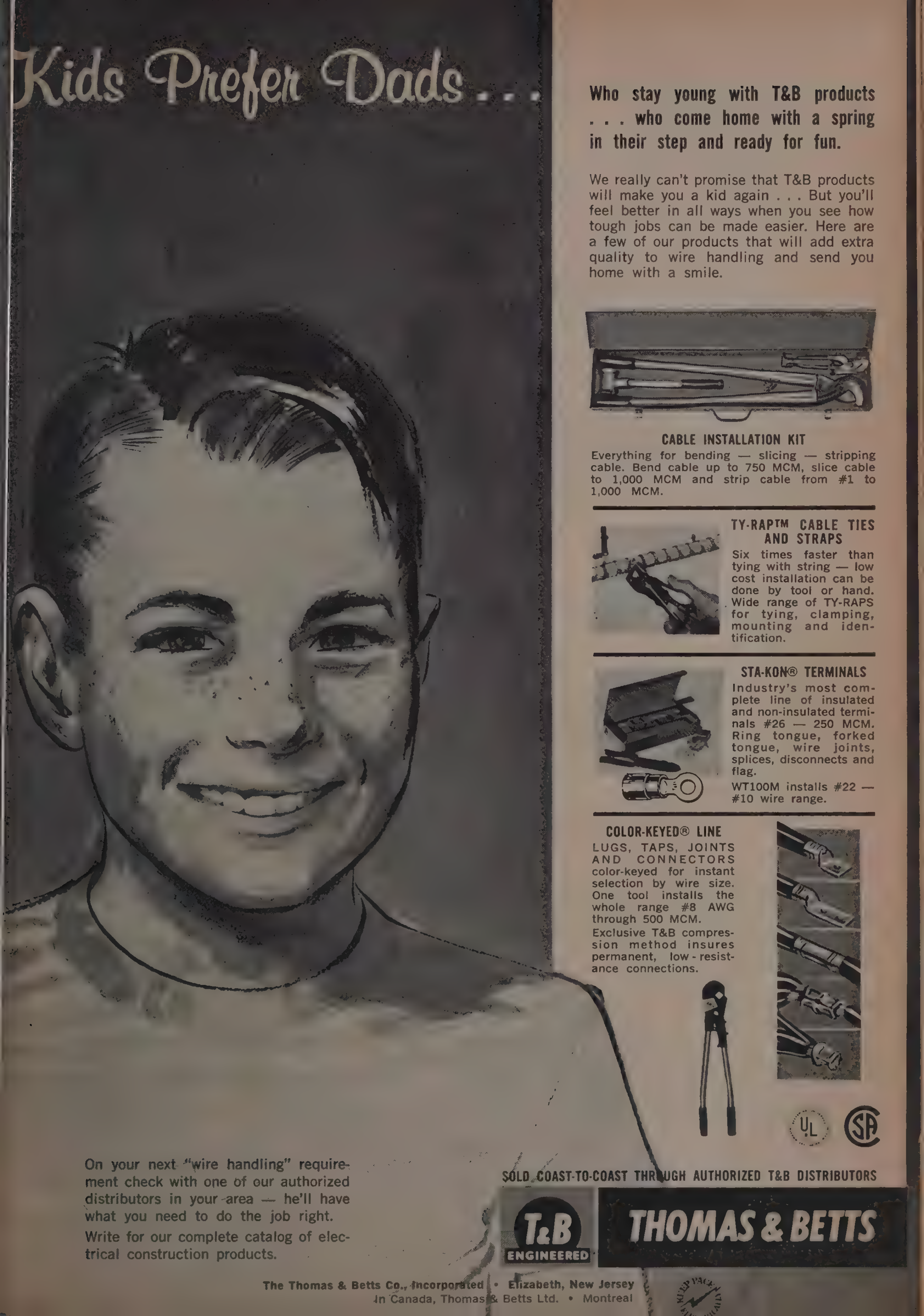
An electric home heating system requiring 6 in. of wiring and weighing 36 lbs has been introduced. Unit, called Microtherm, utilizes a newly developed element with a density factor of 1000 watts per sq in. The Microtherm requires two connections to the home water supply and can be situated 6 in. away from the fuse box or main source of electric supply in the house. The heating system delivers 82,000 Btuh of usable heat, and can be used with a standard circulating pump and standard plumbing parts. The unit is available in two models: Model 1000B25 operates on 240 volts, 100 amps and uses 24 kw, delivering 82,000 Btuh; and Model 9000B15 is 240 volts, 60 amps and uses 15 kw, delivering 50,000 Btuh.

Thermotronics Corp., Westbury, L. I., N. Y.

Lamps (48)

New Series 6850 Quartzoval "1500" for 1500-watt quartz-iodine lamps provides a choice of wide, medium or narrow beam reflectors. Design of luminaire provides precise beam control and sharp vertical cut-off. Three mountings—cross arm, flat base and 2-in. slip fitter—are offered. Units have degree-marked fittings for easy vertical and horizontal aiming and feature a compartment with removable cover for making splices and to house the 8-amp cartridge fuse and holder. Bulletin 100-47 is available.

Revere Electric Mfg. Co., 7420 *Lehigh Ave., Chicago* 48, *Ill.*



Kids Prefer Dads . . .

Who stay young with T&B products . . . who come home with a spring in their step and ready for fun.

We really can't promise that T&B products will make you a kid again . . . But you'll feel better in all ways when you see how tough jobs can be made easier. Here are a few of our products that will add extra quality to wire handling and send you home with a smile.

CABLE INSTALLATION KIT

Everything for bending — slicing — stripping cable. Bend cable up to 750 MCM, slice cable to 1,000 MCM and strip cable from #1 to 1,000 MCM.

TY-RAP™ CABLE TIES AND STRAPS

Six times faster than tying with string — low cost installation can be done by tool or hand. Wide range of TY-RAPS for tying, clamping, mounting and identification.

STA-KON® TERMINALS

Industry's most complete line of insulated and non-insulated terminals #26 — 250 MCM. Ring tongue, forked tongue, wire joints, splices, disconnects and flag.

WT100M installs #22 — #10 wire range.

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LUGS, TAPS, JOINTS AND CONNECTORS color-keyed for instant selection by wire size. One tool installs the whole range #8 AWG through 500 MCM. Exclusive T&B compression method insures permanent, low-resistance connections.

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Subsidiary of American Machine & Foundry Company
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Time is money... control it with Paragon

Floodlight (49)

A new floodlight, known as "Broadlite," providing a broad beam for specific applications, has been designed. Made in two series—for 400- and 1000-watt mercury vapor lamps, color improved, white or clear—for sports fields, parking lots, exterior building illumination, shopping centers, etc. Beam pattern can be varied from 164 by 112 95 by 96 to 17 by 17 degrees horizontally and vertically respectively, depending on distance from area to be lighted. Unit has an aluminum reflector, with or without outdoor ballasts or for use with all popular mounting brackets. Literature is available.

Spero Electric Corp., 18222 *Lanken Ave., Cleveland* 19, *Ohio*

Pilot Light (50)

New neon lamp pilot light is designed to fit standard switch wall plates. Red plastic dome fits through switch plate opening and the Pressure-Lock terminals accommodate No. 12 or 14 AWG wire. Available in 125-volt, 1/25 watt rating or 277-volt, 1/25 watt.

General Electric Co., Providence, R. I.

Commercial Clocks (51)

Surface and flush mounting, double-faced commercial clocks for schools, institutions, manufacturing plants and offices have been added to this line of electrical wall clocks. These satin-finished aluminum timepieces are suspension mounted and available in 12- and 15-in. sizes. Flush and surface mounting versions are offered in 8-, 12- and 15-in. sizes.

Edwards Co., Inc., Norwalk, Conn.

Dimming Control (52)

A new dimming control, called the Capri, features a complete current break when unit is in OFF position. It is suitable for either incandescent or fluorescent. Unit fits in an ordinary 2 in. deep switchbox, and is suitable for single or multigang installation. Rated at 600 watts, with an exclusive cooling system, the Capri operates over a full lighting range up to 98% full brilliance.

Lutron Electronics Co., Inc., Emmaus, Pa.

Band Saw (53)

A new, 2-speed portable electric band saw, called "Porta-Band," is designed for extra-heavy-duty cutting of steel, brass, aluminum, copper, plastic and similar materials. Saw capacity is 3¼ in. by 4¼ in. for rectangular stock and 3¼-in. diameter for round stock. It has a conveniently located toggle switch. Universal ac-dc motor is rated 115 volts, 25-60 cycles.

Rockwell Manufacturing Co., 400 *N. Lexington Ave., Pittsburgh* 8, *Pa.*

Generator (54)

A compact power generator for supplying auxiliary 110-volt electric power has been introduced. Unit rides piggy-back on a vehicle's existing 6- or 12-volt generator. An installation kit is available for each generator and includes mounting brackets, panel switches, double groove pulley and belt. Both dc and ac models are available. Model 12 unit produces 1200 watts dc; Model 100 produces 1000 watts ac.

Cordem Corp., 7600 *Highway* 7, *Minneapolis* 26, *Minn.*

Product Briefs

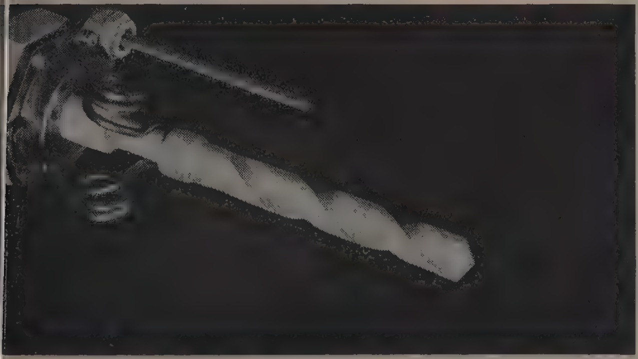
(55) Federal Sign and Signal Corp., Signal Div., Blue Island, Ill., has introduced a new audible industrial **signal** called the "Pulsator." . . . (56) A fully-transistorized portable **intercom**, for residential or commercial use, which plugs into any ac electrical outlet, has been announced by Fasco Industries, Inc., Rochester, N. Y.

(57) W. H. Dickerman Co., Milwaukee, Wis., are now manufacturing unbreakable all-nylon plier-like **tongs**, called "Fuz-tongs" which handle fuses up to 100-amp capacity. . . . (58) A new miniature **humidity sensor** for indication and control has been introduced by the Special Sensor Products Group of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

(59) Talk-A-Phone Co., Chicago,

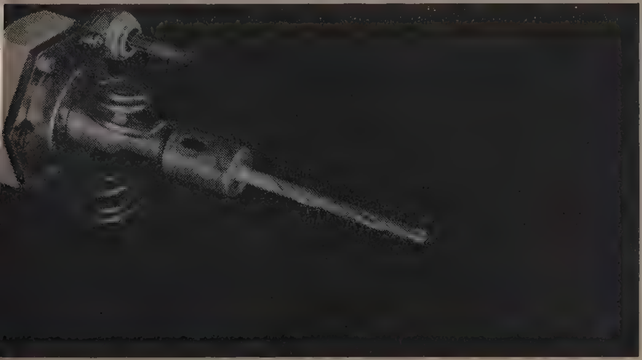
LOOK WHAT YOU CAN DO WITH A NEW SKIL ROTO-HAMMER

no other hammer does nearly as many jobs!

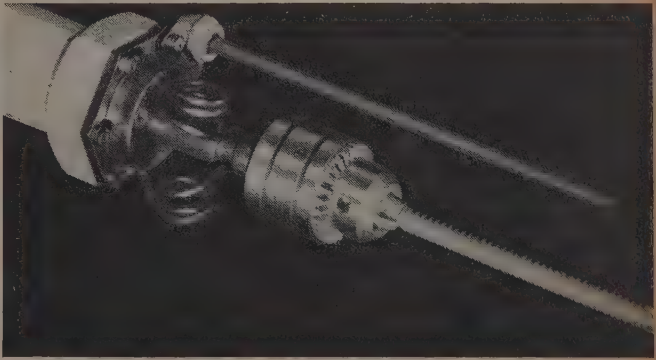


Make ¼″ to 2″ dia. masonry holes faster, at lowest cost with Skil Percussion-Type Carbide Bits. *Roto-Hammer drills while hammering!*

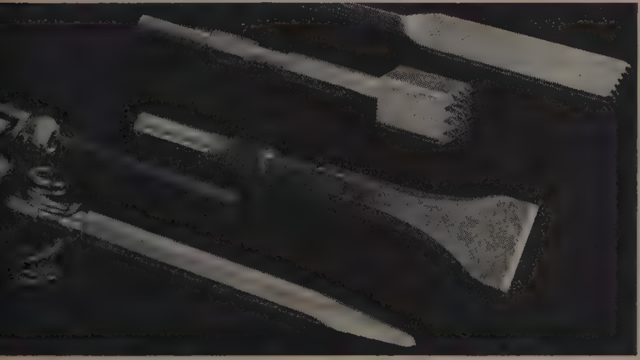
Make big 1¼″ to 3½″ dia. holes in reinforced masonry with Skil Carbide Tipped Core Bits. *Roto-Hammer drills while hammering!*



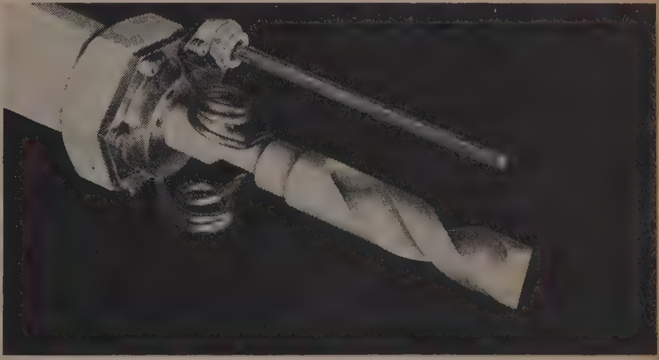
Make holes as small as 11/64″ dia. thru wood into masonry with Skil Percussion-Type Steel Bits. *Roto-Hammer drills while hammering!*



Use as an electric drill. Insert Skil Chuck and do regular wood, metal, masonry drilling. *Roto-Hammer can drill without hammering!*



Do all regular hammering such as channeling, chipping, demolition work with Skil Hammering Tools. *Roto-Hammer can hammer without drilling!*



Make holes for anchors, expansion shields fast new way with Skil "Flat-Tip" Carbide Bits. *Roto-Hammer drills while hammering!*

You're probably losing money if you're not yet using Skil Roto-Hammers. Want proof? Ask your Skil Distributor for a demonstration today. He's listed under "Tools-Electric" in the Yellow Pages. Or write for Free 68-page Skil Catalog. Skil Corporation, Dept. 130F, 5033 Elston Avenue, Chicago 30, Illinois.

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GROUND TO ARMOR OR STRUCTURE

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to simplify the job!

Why take chances on incorrectly designed cable terminations and splices—or on having all the materials on hand that are needed to make them correctly?

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TERMINATING AND
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Ill., has announced three versatile new **intercommunication systems**, designed for office or industrial use. . . . (60) Static rigid recessed **fixtures** can be converted into **adjustable spotlights** with new "Convert-A-Lites" introduced by Swivelier Co., Inc., New York, N. Y.

(61) Cox & Co., Inc., New York, N. Y., has announced the Melt-O-Mat, an electrical **snow melter** for installation beneath walks, driveways, steps and other paved surfaces. . . . (62) A new line of stainless steel **wall plates for electrical switches** has been announced by Harvey Hubbell, Inc., Bridgeport, Conn.

(63) Electric Generator Div., Pioneer Gen-E-Motor Corp., Chicago, Ill., has introduced the Model DE 2500 S diesel **generator** which is a part of the "Pincor Gold Crown" series, producing 2500 watts continuously at 115 volts ac. . . . (64) A line of dry-type **transformers** with lower sound levels through the use of built-in "vibration-isolators" has been announced by Atlantic Transformer Co., Philadelphia, Pa.

(65) Rodale Mfg. Co., Inc., Emmaus, Pa., announces the "Quiet Twins" **switches** available with standard toggle and rocker button. . . . (66) Two independent neutral connectors with individual clamping screws is the new feature of the S-2 series of die cast **meter sockets** being manufactured by General Electric Co., Meter Dept., Somersworth, N. H.

(67) Minneapolis-Honeywell Regulator Co., Residential Div., Minneapolis, Minn., has introduced a new series of line-voltage **thermostats** for heating and cooling systems. . . . (68) Old vacuum tube street **lighting controls** which are mounted on a meter socket base can be converted to modern cadmium cell control with a new auxiliary relay manufactured by American Electric Mfg. Corp., Memphis, Tenn.

(69) Stearns Electric Corp., Milwaukee, Wis., has announced a new, high-torque **clutch-brake combination**. . . . (70) A new home **fire detection system** for installation by electrical contractors called the "Pyrolarm" has been introduced by Solar Sonic Devices, Inc., Hicksville, N. Y.

Catalogs & Bulletins

(71) Lighting Maintenance is the title of 16-page illustrated technical publication which covers complete data on lighting system maintenance through systematic relamping and cleaning practices. General Electric Co.

(72) Outdoor Lighting is described in new 16-page bulletin. Photographs and diagrams illustrate residential applications of wide variety of fixtures. Westinghouse Lamp Div.

(73) AC Generators from less than 1 up to 1,000 kw are described in new brochure. Kato Engineering Co.

(74) Switchboard Instruments. Bulletin GEZ-3428 describes new line of Type 180 edgewise/ammeters and voltmeters. General Electric Co.

(75) Resistance Tester incorporating a Wheatstone Bridge for measuring resistances from a fraction of an ohm up to 1000 megohms is described in 8-page Bulletin 21-60. James G. Biddle Co.

(76) Fluorescent Lamp Ballasts are described in 16-page manual with a special section on operation and care. Universal Mfg. Corp.

(77) Control System. New Stata crane control with Corpak power amplifiers is described in 28-page Bulletin 6401. Square D Co., EC&M Div.

(78) Street Lighting. Engineering data and services for the design of street lighting refractors are featured in new Brochure LS-45 entitled "Pyrex Brand Refractors for Street Lighting." Corning Glass Works, Lighting Glassware Dept.

(79) Motors. Catalog presents the company's entire line of ac and dc motors and custom engineered drive assemblies. Piqua Machine and Mfg. Co.

(80) Underfloor Distribution. 6-page folder tells how Fordham University's new School of Law in New York City used precast concrete floor and roof slabs for fast erection, complete fire safety and underfloor electric distribution. Flexicore Co., Inc.

In dark places like this...

Built-in locator bulb lights G-E switch handle when switch is Off.

G-E lighted handle Silent Mercury Switches make your work stand out!

Would you like an easy way to impress customers – something special they can remember you by?

Install easy-to-find G-E *Lighted Handle* Silent Mercury Switches in baths, hallways, bedrooms, basements and other places likely to be entered in the dark. And put in smooth-operating non-lighted G-E mercury switches everywhere else.

Homeowners like the convenience and complete silence of these General Electric switches. Builders like them as a low-cost sales feature. And you'll like the way they save you call-backs (extra dependable: only one moving part!)

Available lighted and non-lighted in single pole and 3-way – non-lighted also in double pole and 4-way. Specification Grade — 15A-120V AC; 10A-125V T. U-L Listed; meet Federal, REA specifications. General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

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NOW — CARRY JUST ONE DRILL ON ALL YOUR JOBS!

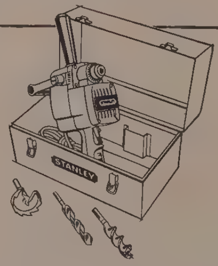
NEW STANLEY ALL-PURPOSE ½″ DRILL

combines the functions of both straight and right angle drills in one compact unit!

As short as 5¾″ from chuck end to rear of gear housing and only 3⅜″ wide, the new Stanley All-Purpose ½″ Drill gets easily into recessed areas and other hard-to-reach spots. Compact as a ¼″ drill, it provides the speed, power and torque you need for fast drilling in tough materials.

For even greater versatility, the Stanley All-Purpose Drill has 3 handles: a non-removable switch handle; a removable spade handle; and a die-cast auxiliary handle that can be mounted on the top, the right side or the left side . . . providing the right set-up for any job. Designed to take heavy-duty operation in stride.

AVAILABLE IN HANDY KIT
The Stanley All-Purpose ½″ Reversing Drill (No. 723) is available in this handy "Artisan's Kit." Designed specifically to meet your needs, this kit includes: All-Purpose Drill (220 R.P.M. Full Load-Reversing) ¾″ electrician's bit, ⅛″ auger bit, 2-9/16″ self feed bit, and sturdy metal carrying case.



OTHER MODELS: No. H722, ½″, 300 R.P.M.; No. 724, ½″, 550 R.P.M.; No. 725, ½″, 250 R.P.M. All R.P.M.'s are full load.

FOR COMPLETE INFORMATION . . . see your Stanley Supplier or write direct.

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(81) RELAYS. 4-page Bulletin 48-B1 describes application and operation of ambient temperature compensated thermal overload relay. Furnas Electric Co.

(82) LIGHTING. Catalog (A.I.A. File No. 31-F-23) illustrates Magnabeam lights designed specifically for window and interior store display, business and trade show exhibits. Esco Lighting Co., Inc.

(83) WIRING CHANNEL. 130-page catalog-handbook describes Kindorf channel, fittings, hangers and supports indexed by product application of structural support materials. Steel City Electric Co.

(84) PUSHBUTTONS. Booklet B-7354 describes standard and special types of general purpose pushbuttons and enclosures for various applications. Westinghouse Electric Corp.

(85) STATIC INVERTERS for converting dc emergency stand-by power into ac power is described in Bulletin GEA-7522. General Electric Co.

(86) HOSPITAL LIGHTING. 16-page brochure entitled "A New Illumination Concept" describes the Centron-10 hospital lighting and patient service system. Sunbeam Lighting Co.

(87) ALARM SYSTEM. 4-page booklet describes and illustrates the firewatch zoned alarm system. Slater Electric Inc.

(88) WIRING DEVICES. 8-page Form No. 32-6 describes weatherproof devices. Bell Electric Co.

(89) SERVICE ENTRANCE EQUIPMENT. 8-page bulletin covers complete line of 200-amp service entrance equipment. Murray Mfg. Corp.

(90) ENERGY SYSTEMS. 20-page "Design Engineer's Energy Data Book" contains engineering design information on the new compact high-energy battery systems. Yardney Electric Corp.

(91) SPEED DRIVES. 8-page bulletin describes ac-dc variable speed drive packages which consist of a magnetic amplifier control panel, a dc motor and a speed control potentiometer. Fidelity Instrument Corp.

(92) CEILING LIGHTING. Second edition of Architectural Design Manual illustrates various ceiling and fixture installations. Luminous Ceilings Inc.

(93) SERVICE ENTRANCE PARTS. 4-page folder describes wireholders, pipe mast clevis and service drop conduit brace. Universal Electric Mast Equipment Co.

(94) STAGE LIGHTING. 24-page Bulletin 105 covers typical layouts, background projection systems and scenic designs for auditorium and stage plans. Hub Electric Co., Inc.

(95) TEST UNITS for calibration of overload relays, protective relays and reclosers are described in 4-page Bulletin SB-361. Multi-Amp Div.

(96) PORTABLE TEST UNITS for analyzing circuit breaker operation are described in Bulletin SB-CB-1. Multi-Amp Div.

(97) BALLASTS. 24-page Bulletin GEC-983R contains complete listings of ratings and data for full line of fluorescent lamp ballasts. General Electric Co.

(98) LIGHTING. New catalog covers complete line of die cast aluminum weatherproof lighting fixtures for sealed beam lamps. Moldcast Mfg. Co.

(99) BUS DUCT. 12-page Booklet B-7360 describes low impedance bus duct including a discussion of the plug-in fittings and accessories that can be used with the duct. Westinghouse Electric Corp.

(100) ELECTRICAL INSULATION Buyer's Guide (IMDB-2) describes complete line of insulating materials for electrical apparatus ranging from illuminating equipment to switchgear and motors and generators of all sizes. General Electric Co.

(101) MOTORS. Revised Bulletin 2652 features 22 types of motors with descriptions on application uses and available ratings. Louis Allis Co.

(102) FLUORESCENT FIXTURES are described in 32-page illustrated combination catalog and price book. Esco Industries Inc.

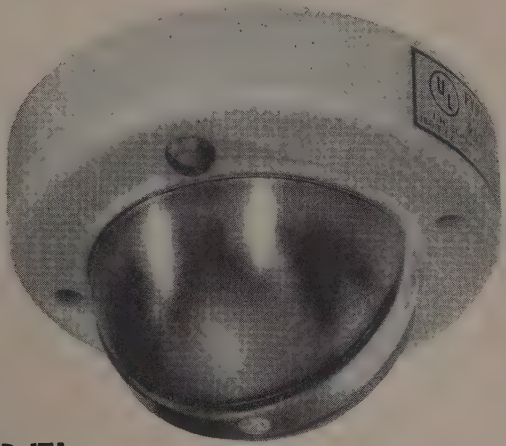
(103) SILICONES. 8-page Catalog CDS-129D describes complete line of silicones and their uses and contains data pertaining to the various silicone products, including a useful selector guide for silicone rubber. General Electric Co.

(104) BALLASTS. New fluorescent lamp ballasts for sign, flashing and weatherproof applications are listed in new catalog. Universal Mfg. Co.

(105) SWITCHES. 20-page Catalog LJ-121 on commercial specialty switches describes 12 different types of switches including push-button, rockette, slide button, toggle and trigger operated devices. Cutler-Hammer Inc.

Yesterday your best customer –
Today a dead loss –

SELL CUSTOMERS
KIDDE FIRE DETECTION–



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YOU MAKE A GOOD PROFIT! 60% of all businesses that suffer severe-loss fires shut their doors forever. Make sure *your* customers stay in business! Sell them the modern Kidde FYRINDEX Detection System. They need it. You'll turn a good profit every sale you make.

EXPANDABLE–EFFICIENT Kidde FYRINDEX, built around the compact detector shown above, is an expandable system that can serve one room or acres of factory space. Customers like the FYRINDEX. It not only responds quickly, but can be heat tested periodically without damage. Customers can also paint the FYRINDEX detector without impairing its efficiency. It is unaffected by dust, humidity, corrosive air particles and vibration.

SIMPLE–
EASY TO INSTALL – Components: FYRINDEX Spot Detector, control box, distinct horn, wiring. Detector operates on fixed temperature and rate of rise principles, is rated to cover 2500 sq. ft. It mounts on a standard 3½″ box, is provided with knockouts for surface and concealed wiring, meets U.L. and F.M. specifications.

FOR MORE INFORMATION – get in touch with your electrical wholesaler or write direct to Kidde.

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Walter Kidde & Company, Inc., 685 Brighton Road, Clifton, N.J.

One final test for cable reliability…

This Circle power cable is undergoing its final performance test before being shipped. Shown here is the IPCEA-NEMA "double-voltage" test for dielectric strength. You can rest assured the Circle cable will pass it with an extra margin of safety. Circle cable also excels in ozone resistance, long term stability and other essential cable requirements.

Manufacturing high reliability power cable requires expert knowledge of compounding and production that comes only from years of experience. You can get this experience at Circle…plus fast, dependable service. Be sure to specify Circle cable on your next job.

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QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Resistance of Nichrome Wire

QUESTION Z40—At our plant we do considerable annealing of welds on pipe by making heaters of Nichrome wire and using a dc welding machine. How can the cold resistance of the wire be converted to hot resistance in order to get the desired wattages?—E.K.

ANSWER to Z40—Assuming that the cold resistance of the Nichrome-type wire (say an alloy of 80% nickel and 20% chromium) can be accurately determined, a plot of R cold and R hot is the most reliable method of conversion. The hot resistance can be measured by the voltmeter-ammeter method. To obtain hot resistance an ammeter is connected in series with the sample, and a voltmeter capable of accurately measuring the voltage drop across the sample is connected in parallel with it, being careful to make the parallel connections at the two ends where current enters and leaves the Nichrome heater. Current and voltage readings are taken when the heater has reached maximum heat and is stable. By use of Ohm's Law ($E = IR$), the resistance of the heater can then be computed. More data obtained for plotting increases the accuracy of the conversion. Cold resistance obtained by use of resistance bridge, and voltage and current readings to two decimal places would assure good accuracy.—G.M.O.

ANSWER TO Z40—With this dc source the "hot" resistance of one heater, while in operation, can be measured by voltage and amperage readings. Then of course divide voltage by amperage to obtain the desired *hot resistance.*

Then let the unit cool off, and take a "cold" resistance reading. The comparison of these two resistances can be used in cutting the lengths of cold resistance wire, for proper use.

Because of a wide variety of alloyed resistance wires, tables and formulas could be misleading, unless the exact properties and characteristics of a specific resistance wire are known. Even then actual tests, as previously described, will prove beneficial since many factors such as the space occupied by the heater coil, distribution of heat and other variables, must be considered. Finally, select the proper resistance wire for the temperature involved, because overheating the wire will cause premature burnouts.—M.C.T.

Use of 1:1 Ratio Transformers

QUESTION A41 — Why is a 1:1 transformer safe to use in hospitals? I would like to know just what a 1:1 transformer is, and what are some practical applications?—S.L.

ANSWER TO A41—Hospitals in general do not require 1:1 transformers for safety, unless flammable anesthetics is administered at the hospital, then that area is classified as hazardous and certain safety factors must be applied. The first safety objective is to minimize the source of ignition that may set off the highly volatile gases used in anesthetics, and the second is to minimize electric shock hazard.

Electrical circuits serving this area can be a source of ignition and shock hazard should a fault occur. Consequently, to reduce this possibility, the National Fire Protection Association's Bulletin 56 and NEC Article 517, require:

1. that an isolated system be provided
2. that the secondary be an ungrounded system
3. that this system be monitored and provide an alarm through a ground contact indicator.

Isolating transformers (not necessarily with a 1:1 ratio) are those in which the primary and secondary windings are not connected electrically but are linked magnetically. This is what is meant by isolating the secondary; it is free and clear from the usual grounded system that supplies the remainder of the hospital.

Should the primary and secondary have the same number of turns and size of wire, this would be a 1:1 ratio transformer.

It should be clear that the transformer in itself does not provide the margin of safety; but used in conjunction with a monitor and a signal to indicate a leakage to ground, substantial safety is assured.—S.S.

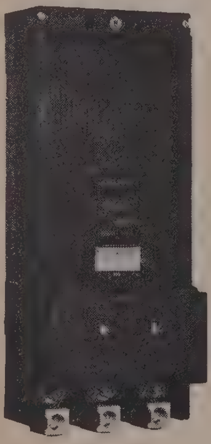
ANSWER TO A41—A 1:1 transformer is one in which the voltage of the primary is the same as the secondary. The NEC requires that certain circuits in a hospital operating room (anesthetizing locations) be supplied from an ungrounded distribution system operating at no more than 300 volts between conductors. Since the incoming supply systems for most hospitals use a grounded neutral on the ac supply, an isolating transformer is then necessary for the operating room circuits. The code also limits the primary supply to no more than 300 volts, so a 1:1 transformer is not always required.

An elaborate system is also provided to detect faulty electrical equipment. During an operation a spark from faulty electrical equipment could endanger the life of a patient if combustible anesthetics are used. The ground detector system must limit the current to the ground from the ground indicator to 2 ma or less. Since ground detectors utilize the current to ground, then it is important to have an ungrounded secondary distribution.

At one time the fluorescent ceiling lights in the operating room were required to be on the ungrounded circuits. Unfortunately, there is always a leakage current to ground from the best of electrical insulations. As manufacturers improved their ground detector systems to comply with code requirements, it was discovered that fluorescent lights could trigger the audible warning system for the operating room even though the equipment was functioning normally. The code was then changed so that the fluorescent lights in the ceiling (except surgical fixtures) could be fed from a grounded system; it was felt that it is better to have the ground indicator working than shut off during an operation. Article 517 of the NEC and NFPA Pamphlet No. 56 gives the specific requirements of such installations.—H.S.H.

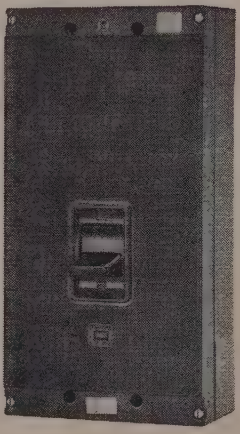
A buyers' guide to optimum circuit protection

100,000 amperes interrupting capacity



TRI-PAC—The Westinghouse Tri-Pac® circuit breaker offers triple circuit protection in one compact unit: an inverse time delay thermal trip, an instantaneous magnetic trip, and current limiting protection. Continuous current rating to 600 amps, two or three poles; interrupting capacity up to 100,000 amps.

High fault protection at low cost



MARK-75—With high interrupting rating, this economical Mark 75 breaker provides complete protection in systems, like networks, where available fault currents may reach 75,000 amperes at 240 volts a-c; 30,000 amperes at 600 volts a-c. Available in current ratings from 70 to 1,000 amps, two or three poles.

Visible contacts for special safety codes

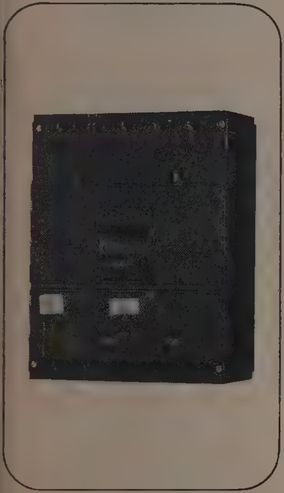
SAF-T-VUE—Saf-T-Vue® breakers permit the operator to *see* whether the contacts are open or closed. This feature is ideal where safety codes require visible contacts for maintenance men and operators. The transparent window is heat-resistant thermo-plastic that won't scorch or cloud with normal overloads. Available in ratings up to 1,000 amps a-c.

Complete protection for most applications

THERMAL-MAGNETIC—Westinghouse Thermal-Magnetic breakers have become the standard for protection of distribution system 600 volts or less. Available in all frame sizes, this breaker provides instantaneous opening on short circuits. On sustained overloads, the higher the current, the shorter the opening time. Factory tested for unmatched reliability; available in ratings to 1,000 amperes.

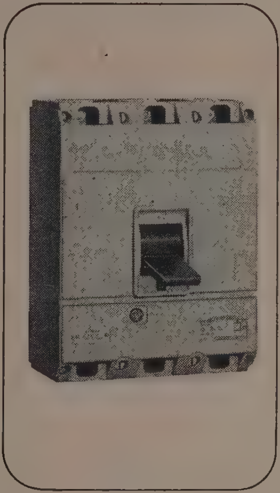
f one molded case circuit breaker served very need, that's all Westinghouse would uild. But precise protection at lowest cost alls for specialized solutions. That's why Vestinghouse builds hundreds of variations o the seven basic types featured here. It's he world's most complete line, based on ver 35 years of continuing product research nd development. Use this buyers' guide for eneral applications. For specific circuit rotection problems, contact your Westingouse representative, Westinghouse distribtor, nearest independent panelboard/ witchboard builder, or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pennsylvania. *You can be sure . . . if it's Westinghouse.*

Fast, short-circuit protection only



MAGNETIC-ONLY—Designed specifically for short circuit protection, the magnetic-only circuit breaker is used on systems where overload protection is provided by other means. Front adjustment allows five main setting positions and four mid-setting positions. Typical applications are motors, resistance welding and resistance heating. Available to 1,000 amperes, continuous current ratings.

Rugged construction for military use



NAVY-TYPE—The Navy-type breaker has very high mechanical strength, and resistance to fire, moisture and shock. Under shock conditions the trip stays in latch position, but doesn't prevent thermal or magnetic trips from overload or short-circuit. Has plug-in connector, interchangeable trip units and calibration for 50°C. Available in ratings to 600 amps at 500 volts a-c.

Precise calibration for low currents

TYPE-550—The Type-550 is designed specifically for sensitive electronic equipment where fractional ampere ratings and exacting protection are required. Special plating resists moisture and fungus. Interrupting capacities range from 1,000 to 3,000 amps with ratings from .02 to 50 amps, maximum voltages of 250 a-c and 50 d-c.

J-30342

Westinghouse

Type T Wire on DC Circuits

QUESTION B41—From some engineers, I heard that thermoplastic insulated wires and cables are not suitable for use on dc circuits, especially in warm and humid climates. Is it true that a minute electrolytic action takes place which gradually breaks down the insulation? I cannot find any rule in the NEC restricting the use of that type of insulation to ac circuits only.—J.A.

ANSWER TO B41—When the Germans, after the last war, rebuilt their cities, they rewired their buildings with polyvinylchloride insulated conductors. They experienced wholesale failures in dc installations. The reason was tracked down to fatty acid ester plasticizers in their PVC compounds, which promoted electro-endosmosis—destruction, in moist locations, of the insulation of the conductor connected to the negative pole. When this became known in this country, the cable manufacturers made extensive tests on conductors insulated with U. S. produced PVC compounds. Because they are compounded with plasticizers containing no fatty acid esters, no failures from electro-endosmosis occurred, neither in the laboratory under very severe test conditions, nor in the field. However, it was found that certain pigments (colors) caused poor performance. This has been corrected, and it can be stated that all U. S. plastic-insulated wires and cables can be used in dc circuits with confidence. —L.F.R.

Commutator Troubles

QUESTION C41—Some trouble is being experienced with a number of 4-pole, compound-wound totally enclosed dc motors due to blackening or burning of every fourth commutator segment, the markings being evenly distributed around the commutator. The commutator connections appear quite sound; the commutators have been skimmed up and the brush positions checked, but the trouble persists. Can any reader suggest the cause and a remedy?—J.L.W.

ANSWER TO C41—From your description, you have what is known as "slot-bar marking," which is a natural phenomenon and can be observed on any machine which has two or more conductors per armature slot. If you look carefully, you will probably find that the marking is on the trailing edge of the marked commutator bars. This type of marking is not serious unless the bars become etched. Very frequently the marking that develops is actually a build-up of film at this point, rather than an etched condition.

Slot-bar marking cannot be entirely eliminated, but it can be controlled to the point that is not damaging or destructive to the machine or brushes in the following manner:

1. By assuring proper electrical adjustment.
2. By utilizing the proper loads on the machine. If the machine is always lightly loaded, the brushes will not have the proper current density to vaporize the film that builds up. Overloaded machines will cause excessive burning. In machines that are always lightly loaded, we have removed several brushes to reduce the markings.
3. Control the atmosphere from contamination.
4. Have a reputable service engineer check the brushes against the operating conditions. It may be advisable to change the brush composition.—I.G.B.

ANSWER TO C41—I would class this trouble in one of two of the following: (1) short circuit in the armature; and (2) open circuit in the armature.

Short Circuit in the Armature—This could be caused by defective insulation in the armature; use growler to test; or use battery and voltmeter and test commutator bar to bar. If it is found to be a short-circuited coil, cut out shorted coil and bridge the adjacent commutator bars as a temporary measure.

Open-Circuited Armature Coil—This could be the result of an armature conductor burned open or the armature conductor becoming open where it connects to the commutator bars. ("J.L.W." doesn't say if this machine is a LAP or WAVE wound machine or how many brushes the machine has.) I would try to remedy the trouble as follows: If it is found to be an open armature conductor, bridge the open circuit by connecting the commutator bars adjacent to the break, or stagger the brushes in all brush holders where there are two or more in line, so as to cover the break.

In the case of a loose connection at the commutator bar proceed as follows: Resolder the connection. (In jumping an open circuit of this kind, be careful not to short circuit a good coil, as this will only aggravate the arcing, besides ruining the coil.)

In this case I would rule out (a) the brushes not being in the neutral plane, (b) the brushes covering too many bars, and (c) poor contact between brush and the commutator. I would definitely consider this either an open armature coil circuit or a shorted armature coil circuit.

If the blackening of the commutator is in general over the entire surface, it could be due to the wrong grade of brush; improper brush tension; or electrolytic action, but as "J.L.W." explains it, this is not the situation.—F.N.S.

ANSWER TO C41—From your question, it seems that you have taken care of one of the more common causes, loose commutator bars. Therefore, I suggest you go to the heart of your problem.

The blackening, or burning, of commutator bars is due to circulating currents. This should also show some signs of overheating on the brushes. If this is so, then your problem is caused by open or broken equalizer connections, However, equalizer connections are used only on lap-wound armatures. Therefore, if you have a lap-wound armature, your problem may be caused by trouble with your equalizer connections. Check this carefully, and make the necessary corrections. —J.A.M.

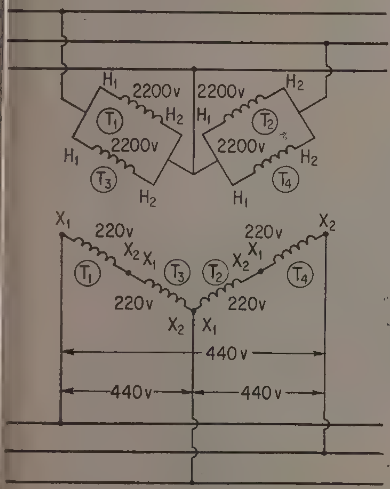
Open-Delta Transformer Connections

QUESTION D41—Having four 5-kva single-phase 2200-volt to 110/220-volt transformers, I wish to have a connection to operate a 3-phase, 440-volt motor. Can this be done?—E.S.H.

ANSWER TO D41—Assuming that you have 2200-volt 3-phase primary feed, such a connection can be made.

The four transformers would have to be connected to operate as two transformers. The primary side of each group of two transformers would have to be connected to operate as two transformers. The primary side of each group of two transformers would have to be connected in parallel and in turn then be connected open delta. The secondary windings would be connected pen delta also. The 110/220 windings of each group of two transormers would have to be connected n series to produce the desired 440 o operate the motor. You did not tate the size of the motor, however f it is over 15 hp you should measure the running current to insure hat you would not be drawing nore current than the transformer econdary windings can safely arry.—D.L.D.

NSWER TO D41—Below is sketch hat will clarify the connection.



The transformers will have to be connected two in parallel on the primary side and these will have to then be connected in open delta. The secondary side will have to be connected open delta but the secondaries are connected in series.

Polarities are marked on the sketch and must be carefully observed to avoid trouble.—F.N.S.

Can You Answer These QUESTIONS?

QUESTION K41—In an electrical installation using vertical busway, is there any code ruling on providing fire stops on the exterior or the interior of the busway? On the exterior when going through a floor, is concrete sufficient or must we use a non-combustible floor material?—V.S.

QUESTION L41—We need a 3-phase 115-volt supply (about 0.1-amp load) for testing at places that have only a single-phase supply. Could someone supply me with the necessary information for constructing such a converter?—H.G.R.

ELECTRIC HEATING product literature draws pre-session attention of D. J. Heyburn, Sr., and D. H. Heyburn, Cranford, N. J. electrical contractors, at recent NEMA Electric Comfort Heating Symposium in Chicago.

QUESTION M41—Many years ago I spent my spare time in an auto battery repair and charging station. At that time the battery often gave out in six months or so because of wooden separators and shedding. It was common to tear them down and rebuild them.

To test the condition of plates they used a cadmium rod dipped into the electrolyte and took a voltage reading from it to *both* plates.

I cannot remember what the voltage should be and cannot find a mention anywhere in text books. Others I have asked do not know the answer.—H.D.B.

QUESTION N41—In the design of underground power distribution systems, I have encountered contradicting opinions and would like to hear what some of the experts in this field have to say.

Most of the designers try to get a "dry" conduit system. They carefully arrange all conduit runs to slope and rain into the manholes; expensive watertight covers are specified; and manholes are waterproofed, etc., to prevent the entrance of water.

Other men say that is a waste of money. Water will sometimes enter ducts and manholes even if the preventative steps, mentioned above, are taken. They insist, that under average conditions, water in ducts and manholes will not harm good cables which are properly installed; the cooling effect of water is very beneficial and will prolong the life of the cable.—J.A.

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Questions on the Code

Answered by:

R. L. LLOYD, *Electrical Safety Engineer, National Bureau of Standards, Washington, D. C.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

READERS are invited to submit questions regarding the National Electrical Code and its practical application to this Department. Questions are answered by the consulting editor whose initials appear at the end of each item. The views and opinions expressed are, in each instance, those of the individual consultant replying and are not necessarily those of his employers, of this publication or of a Code-making committee or panel on which he may serve in an official capacity.

Bathroom Outlets

Q. *Does the code require a convenience outlet in the bathroom in residential occupancy? If so, how many? If not, why?—A.T.*

A. No. It will be noted that paragraph (b) of Section 210-22 does not mention bathrooms.

There is a considerable variance of opinion relative to the use of receptacles in bathrooms. While there is no direct code prohibition for their use, many inspectors do have some hesitancy in permitting their installation in these areas. In spite of this reluctance, I doubt if any residential installations made today are completed without at least one receptacle in the bathroom.

The use of portable equipment in bathrooms is quite dangerous. This is especially true of such items as radios, curlers and similar units where their users handle them while bathing or washing in or near the bathtub or basin. Even though we have gotten away from much of the potential hazards in these areas by making permanent and safe installations of the heating equipment, radio, etc., there are still many portable devices to be found in the bathroom. We must also point out that many of the newer devices are inherently safe; e.g., the approved types of electric razors and electric tooth brushes.—B.Z.S.

Seals for Receptacles

Q. *If a conduit enters a hospital operating room via the floor and feeds a sealed explosion-proof receptacle on the wall one foot above the floor and continues up the wall, across the ceiling and down the wall to a second sealed explosion-proof receptacle on the wall one foot above the floor, what seals are required?—C.K.F.*

A. No additional seals are required if the seal in the receptacle effectively seals the conduit leaving the hazardous area at the 5-ft level. Of course, no coupling or other threaded joint can be placed between this seal and the exit point (5 ft above the floor) of the conduit. If the receptacle seals do not seal the end of the conduit leaving the hazardous area, then additional seals are to be used for the conduits leaving the hazardous area.—R.L.L.

Derating Conductors in Conduit

Q. *The code will permit conductors of certain sizes to be run in multiple or parallel. The code also requires that conductors in conduit be derated according to the number of conductors in the run of conduit.*

As an example, if I parallel three conductors for each phase of a 3-phase system, do I derate the conductors as being nine, or is such an installation considered as three conductors?—H.M.B.

A. Official Interpretation No. 390 issued in 1953 answers your question, which is as follows:

"Section 3105 of the National Electrical Code permits the paralleling of conductors. If five 3/0 conductors are parallel on a 3-phase, 3-wire circuit:

"Question 1: Are these figured as 15 or 3 conductors in so far as the code is concerned?

"Answer: They are figured as 15 conductors.

"Question 2: What percentage of reduction in current carrying capacity must be applied to the paralleled conductors in accordance with Note 4 of Tables 1 and 2 of the 1951 edition of the Code?

"Answer: At least two runs of conduit must be used for the 15 conductors. If 9 conductors were run in one conduit and 6 in the other, the current-carrying capacity for the 9-conductor group would be 70% of normal rating and for the 6-conductor group 80% of normal rating."

I would also refer you to Note 8 of Section 310-11 of the 1959 Code, and according to this note if the conductors are run in a single conduit, the derating factor used would be 70% of values in Tables 310-12 and 310-14 of the code.

When Official Interpretation 390 was issued in 1953 the maximum number of conductors allowed in one run of conduit was nine. The 1959 Code will allow more than nine conductors in one conduit when such conductors are derated according to the above-mentioned Note 8 of Section 310-11.

From the above Official Interpretation, the number of conductors would be considered nine and derated accordingly.—R.E.W.

Classification of Welding Shop

Q. *Would you kindly give me a clarification of this job? It is a welding shop, and has two motor-generator sets on wheels, a torch and cutting tools. The shop does all kinds of welding, including trucks, tools, and equipment of any kind.*

My problem is this. The electrical inspector classifies this area under Article 511 of the National Electrical Code, and I would appreciate your comments pertaining to this situation.—A.B.

A. Because repair of automobiles frequently involves disconnection of fuel lines, removal of the carburetor, drainage of fuel lines and tanks, washing parts in solvent, and similar operations which may permit the release of combustible vapors, such areas are classified as hazardous locations. Where gasoline powered vehicles are stored, gasoline can leak from loose connections or holes caused by corrosion and thus cause the release of combustible vapors. Such

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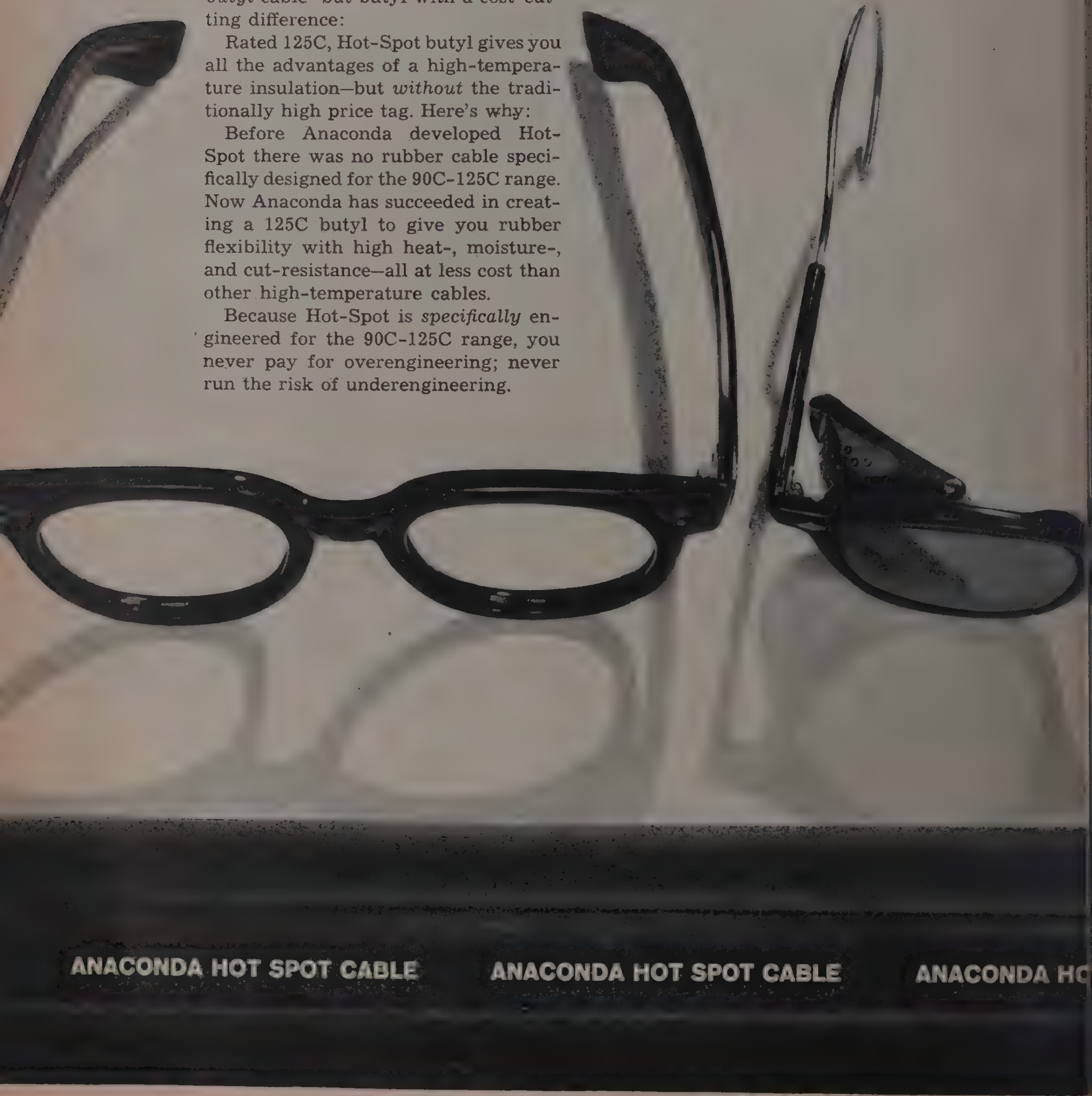

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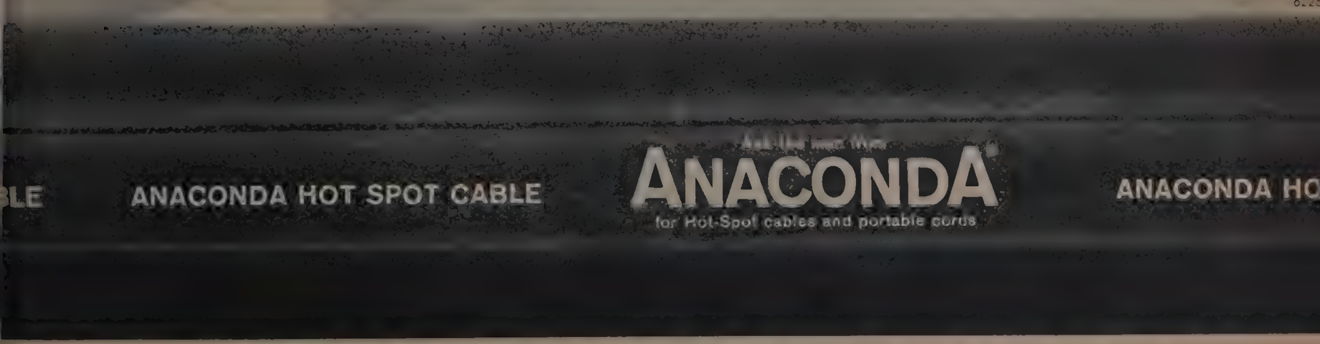

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an area would not be one in which sources of ignition should be present.

In a welding shop, open flame and sources of ignition are present and, therefore, gasoline vapors should not be brought into this area. If the welding shop does only welding repair, and does not engage in any operation on an automobile which would release gasoline vapors, the inspector *may* decide that such an area does not fall within the scope of Article 511 of the code. He may also indicate that some additional restrictions are necessary, such as limiting the number of vehicles in the shop at the same time to three and providing ventilation of a type which would insure that no collection of combustible vapors could occur. It should be realized that while the National Electrical Code indicates the type of electrical wiring in classified areas, it is the responsibility of the local inspection authority enforcing the code to classify any hazardous area within its jurisdiction.—R.L.L.

Solid Walls of Operating Rooms

Q. *Is a wall made up of solid concrete block with a tile face on both sides and a lead sheet in the center considered to be a solid wall in hospital operating rooms?—C.K.F.*

A. Yes. The walls of a hospital operating room whether solid or with hollow spaces within them are considered under Section 517-3 of the National Electrical Code to be within the hazardous area and would be treated the same as wiring located on the surface of the wall inside the operating room. —R.L.L.

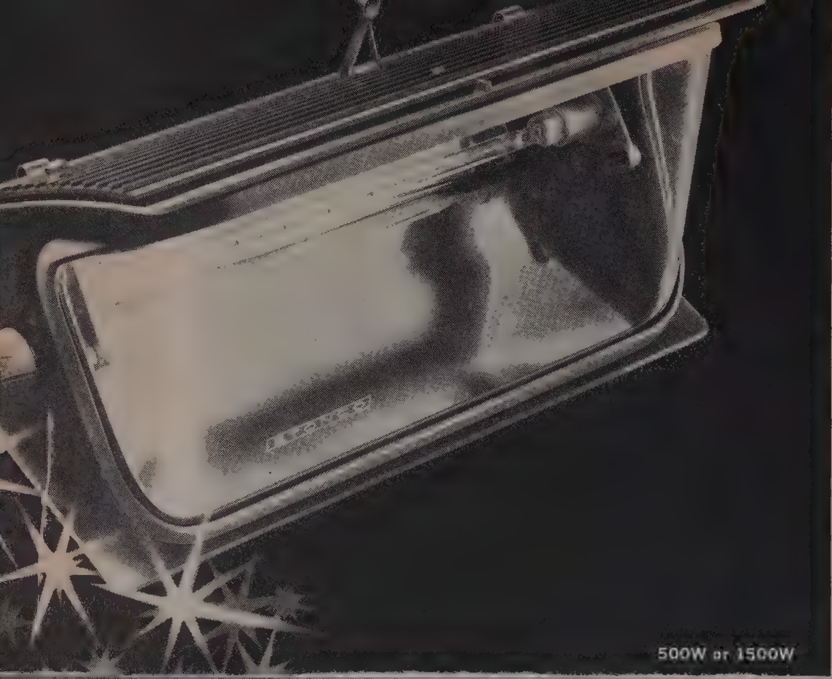
Small Residence Wiring

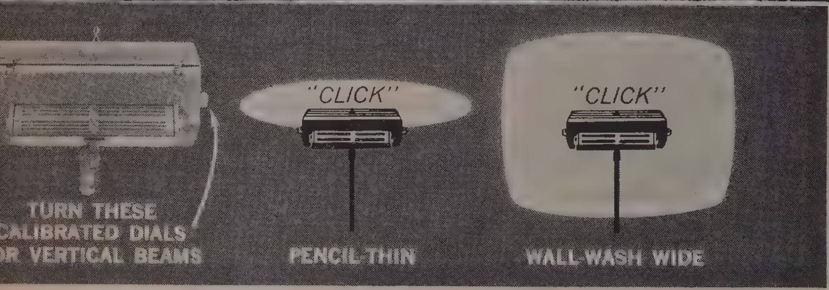
Q. *Is it the intent of paragraph 220-3(b) to require two 20-amp branch circuits in a residence having no more than 525 sq ft of floor space?*

What would be the minimum number of branch circuits required for this residence?

What would be the minimum size of service conductors required for this residence?—B.T.

A. Yes, two 20-amp appliance branch circuits would be required. The code would require a





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inimum of three branch circuits or this small residence. Two 20-mp branch circuits, as stated bove, would be required for the mall appliance loads and a third or the balance of lighting and re-eptacle loads.

The minimum size of service con-luctors would be No. 6 as required y Section 230-41.—B.Z.S.

Derating Branch-Circuit Loads

Q. *I had a recent installation involving the wiring of fluorescent fixtures in an office building. Several conduit home runs carried two 4-wire 208Y/120-volt branch circuits, for which we intended to install No. 12 wire connected to 20-amp circuit breaker in the panelboard. However, our local inspection department stated that since the installation involved fluorescent lighting on 4-wire 3-phase circuits, we would have to reduce the load to 70% of the carrying-capacity of the branch-circuit conductors as listed in NEC Table 310-12 where any conduit contained eight conductors.*

It was also their decision that we would have to use No. 10 wire if we wanted to use 20-amp branch circuits, loaded at 16 amps or less, where a conduit would contain eight conductors. They further stated that 15-amp circuit breakers, loaded at not more than 12 amps, would be required if we used eight No. 12 conductors in one conduit.

Why couldn't we use 20-amp circuit breakers with loads not exceeding 14 amps on the No. 12 wire? Our local code rules are based on the NEC so special rules are not involved.—J.K.L.

A. Official Interpretation No. 355, issued May 8, 1950, is as follows with the notations in parentheses indicating the cross-reference equivalents in the 1959 NEC:

"Question 1. Table 1 (Table 310-12). Is the intention of the code that Table 1 (Table 310-12) permits six 115-volt branch lighting circuits derived from a 3-phase 4-wire supply and comprising a total of eight No. 12 conductors to be run in a single conduit?

"Answer: Yes.

"Question 2. Section 2403 (240-7): In view of the reduced allowable current specified in Table 1, Note 4 (Table 310-12, Note 8) for the conductors installed in this single conduit, may single-pole non-adjustable circuit breakers, rated 20 amps, be chosen as the overcurrent protection specified in paragraph b, Section 2403 (paragraph a, Section 240-7) of the code?

"Answer: Yes."

From the above official interpretation my answer is that your installation would meet code requirements when installed according to the last part of your question, using 20-amp circuit breakers with loads not exceeding 14 amps on the No. 12 wire.—R.E.W.

Readily Accessible Motor Disconnecting Means

Q. *Where horizontal busway is used and mounted over 8 ft above the floor, would a disconnect switch mounted on the busway meet the requirements for ready accessibility for a motor circuit?—R.B.*

A. Only if the switch was provided with a lever or pull chain which is within reach from the floor. The exception made for overcurrent devices for busways in Section 240-16 and 364-11 does not relieve the requirement of Section 430-107, which requires the disconnecting means for a motor circuit to be readily accessible.—R.L.L.

Grounding-Type Receptacles

Q. *Does Section 250-59, as written, state that receptacles shall be installed? If answer is no, then how can Section 210-7 specify that receptacles as required by Section 250-59 be grounding receptacles? If so, where is it required? —J.M.*

A. Your question concerning Section 210-7 does not fully cover the wording of 210-7, which is as follows:

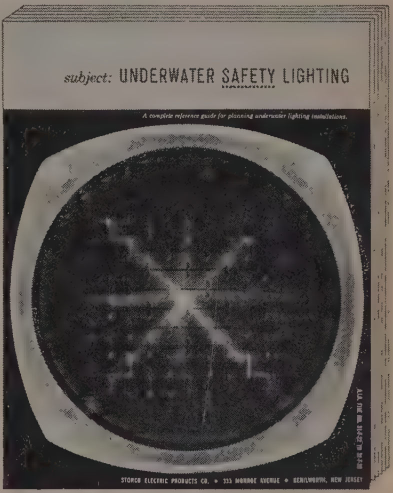
"Grounding Receptacles. Where a grounding receptacle is installed as specified in Sections 210-22(b) and 250-59, to provide grounding facilities required in Section 250-45, the branch circuit or branch-circuit raceway shall include or provide a grounding conductor to which the grounding contacts of the grounding receptacle shall be connected. The metal armor of armored cable or a metallic raceway is acceptable as a grounding conductor."

You will note after the number 59 there is a comma. Following this

SEND FOR THIS . . .

free manual:

UNDERWATER SAFETY LIGHTING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comma are the words "to provid grounding facilities required i Section 250-45." Section 250-45 pertains to the grounding of portabl equipment, and states under wha conditions the exposed non-curren carrying metal parts of portabl equipment shall be grounded. Thi section contains paragraphs (a), (b), (c) and (d). Paragraph (c pertains to residential occupancies and the other three paragraphs apply to other occupancies, or in som instances (a), (b) and (d) coul apply in a residential occupancy.

Section 250-59 pertains to th methods whereby such portabl equipment may be grounded, either residential or non-residential Therefore, if the person responsible for grounding portable equipment (as required in Section 250-45) elected to use a grounding receptacle as a means of grounding, which is allowable in Section 250-59, then such person, in order to meet code requirements, would be required to install the grounding receptacles as is indicated in Section 210-7.—R.E.W.

Seals at Limit of Hazardous Area

Q. *If a speaker is located 5 ft 6 in. high on the wall of an operating room and an explosion-proof elbow switch controlling it is located at the 4-ft level, is a seal required between the switch and the speaker, knowing the communication voltage to be less than 8 volts?—C.K.F.*

A. Yes, unless the seal provided in the switch also effectively seals the end of the conduit extending outside of the hazardous area to the speaker. The voltage stated is no basis for not requiring seals. Unless the power supplied to the speaker was obtained from equipment judged to be intrinsically safe, the requirements for seals as covered in Paragraph 501-5(a)(3) apply.—R.L.L.

Fluorescent Fixture on Fiberboard Ceilings

Q. *Inquiries directed to distributors of fluorescent fixtures concerning surface mounting of pans containing ballasts on fibrous tile ceilings always draw a blank. No one in the trade seems to know*

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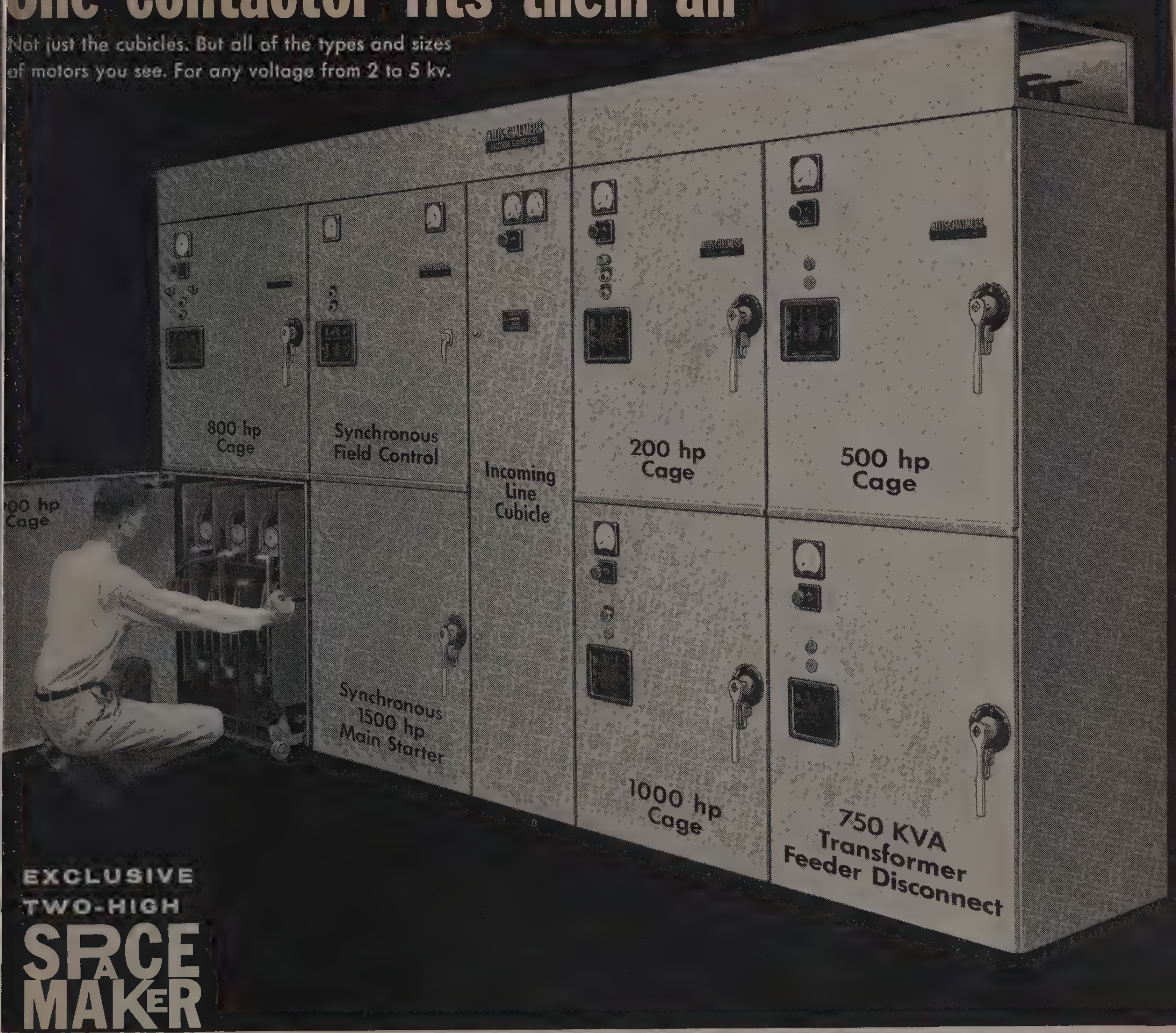
Not just the cubicles. But all of the types and sizes of motors you see. For any voltage from 2 to 5 kv.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A-1651

what fixture or pan would meet the code requirement specified in Paragraph 410-74(b1), "be approved for this condition."

Would the insertion of ⅛-in. hardboard sheets between the pans and the ceiling tile meet the requirements of 410-74? If this would not, how do you suggest we comply with the requirements of this code section, or can you supply us with name or names of fixtures approved for direct mounting against such ceiling? Is there basis for such a code requirement?—W.W.

A. For the benefit of our readers, Section 410-74 is as follows:

"Fixture Mounting.

"(a) Exposed Ballasts. Fixtures having exposed ballasts or transformers shall be so installed that such ballasts or transformers shall not be in contact with combustible material.

"(b) Combustible Low-Density Cellulose Fiberboard. Where a fixture containing a ballast is to be installed on combustible low-density cellulose fiberboard it shall, where surface mounted:

"(1) Be approved for this condition, or

"(2) Be spaced not less than 1½ inches from the surface of the fiberboard.

"(3) Where such fixtures are partially or wholly recessed, the provisions of Section 410-62 to 410-70 shall apply.

"Combustible low-density cellulose fiberboard is considered to include sheets, panels and tiles which have a density of 20 pounds per cubic foot or less, and which are formed of bonded plant fiber material; but does not include solid or laminated wood, nor fiberboard which has a density in excess of 20 pounds per cubic foot."

Your questions concern a code requirement that has received far too little attention from electrical wholesalers, installers of lighting fixtures, and inspection authorities. This section is one of the most important sections in the NEC as far as fire prevention is concerned. I base my statement on actual cases of investigations I have made of installations where breakdowns of ballasts have occurred. One such case was within the last year where a listed fluorescent fixture was mounted against a metal ceiling secured to wood lathing, such wood lathing being ⅞-in. thick by 4 in. wide. The heat from the ballast was so intense the wood lath caught fire, which was located between the metal ceiling and the flooring of the story above where the fixture was located. In other words, the heat was conducted from the housing of the ballast through the metal housing of the fixture, through the metal ceiling to the wood lathing. This fire occurred in a mercantile establishment, and the odor of the melting compound of the ballast was detected some three hours before the fire was discovered.

The fire damage was minor compared to the water damage, and the evidence in this case was as plain as to what happened as any that I have investigated in over 22 years of investigation and inspection work with the State of Tennessee in the Fire Prevention Division.

I am happy to report progress is being made by manufacturers in developing a ballast that will assure a much safer and satisfactory installation, regardless of location, where such ballasts are used in place of the many millions of ballasts now in use that do not have safety protective measures incorporated either in the ballast or fixture. This safety feature is approached by several different methods, one being an inherent thermal protector.

Recently one of the major manufacturers of ballasts issued a bulletin regarding their line of ballasts equipped with a safety device, stating in the bulletin that a number of fixture manufacturers have been working for some months to obtain UL listing of their fixtures for direct mounting against low-density cellulose fiberboard ceilings.

As a member of the Electrical Council of Underwriters' Laboratories, the writer has recently reviewed a report on such a lighting fixture using another manufacturer's ballast. To my knowledge there is one fixture manufacturer that now has a listed fixture approved for mounting in conformity with Paragraph 410-74(b-1). I refer to the Gibson Manufacturing Co., Atlanta, Ga. There may be more listed fixtures at this time as I do know several manufacturers have submitted their fixtures to UL. I am sure within a short time we will have a selection of fixtures approved for the purpose mentioned.

With the background of investigations I have made, the installation of hardboard sheets would not be acceptable and does not meet code requirements for such an installation. As you will note 410-74(b-2) states: "be spaced not less than 1½ in. from the surface of

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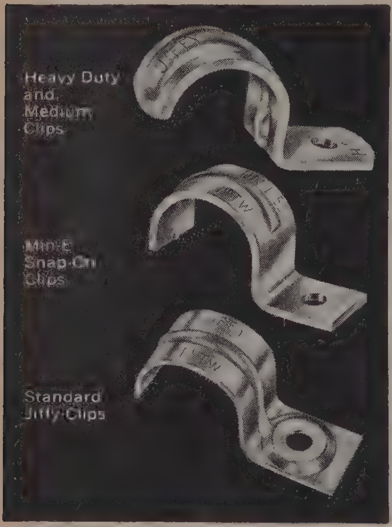

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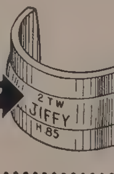

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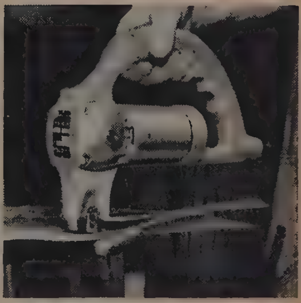

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the fiberboard." The insertion of the hardboard or other material would not meet the requirements as the separation required would not be obtained.

I have suggested that standards should be such that fixtures equipped with ballasts that are suitable for such use be so designed that it would be difficult to mount the standard type ballast as a replacement unit for one of the protected type. It would also be desirable if the design was such that the new protective type ballast could replace the standard type in existing installations.—R.E.W.

Externally Operable Switches

Q. *The code requires that the disconnecting means for services meet certain requirements, among which is that an enclosed service switch or circuit breaker shall be externally operable.*

Can a switch that has a hinged door with a disconnecting means in the form of a pull-out be classed as meeting the requirement of externally operable?—L.D.

A. Yes. Article 100 of the NEC defines "externally operable" as follows:

"Externally Operable: (As applied to equipment that is enclosed in a case or cabinet.) Capable of being operated without exposing the operator to contact with live parts."

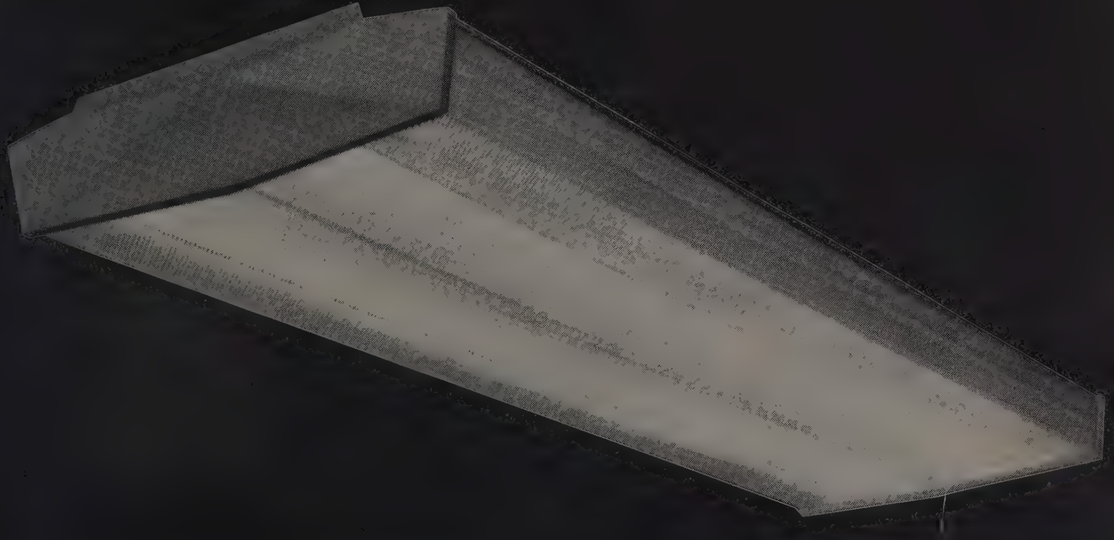
A note of explanation in the Abbott and Stetka NEC Handbook states:

"Switches and circuit breakers are in many cases required to be externally operable.

"If a switch or circuit breaker is mounted in a cabinet or box and cannot be operated until the door is opened, the device is still to be considered as externally operable if no live parts are exposed when the door is opened."

Service switches that are listed by UL will, in most instances, be marked "suitable for use as service equipment." When the label on a piece of equipment states the use of such equipment, one is assured that code requirements have been followed by UL in the listing of such equipment. Therefore, switches such as you describe, when labeled by UL for use as service equipment, meet code requirement for service equipment.—R.E.W.

LPI CRITERION



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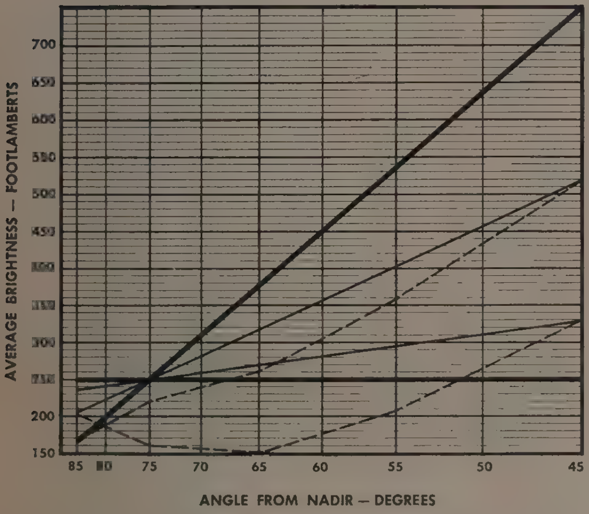

Visual comfort of the Criterion I series in the direct glare zone is depicted in accordance with the "scissors curve" method recommended by the Illuminating Engineering Society. The ratio of maximum brightness to average brightness is well within the recommended three-to-one limits for comfort at each angle. A complete photometric analysis by E.T.L. is available upon request.

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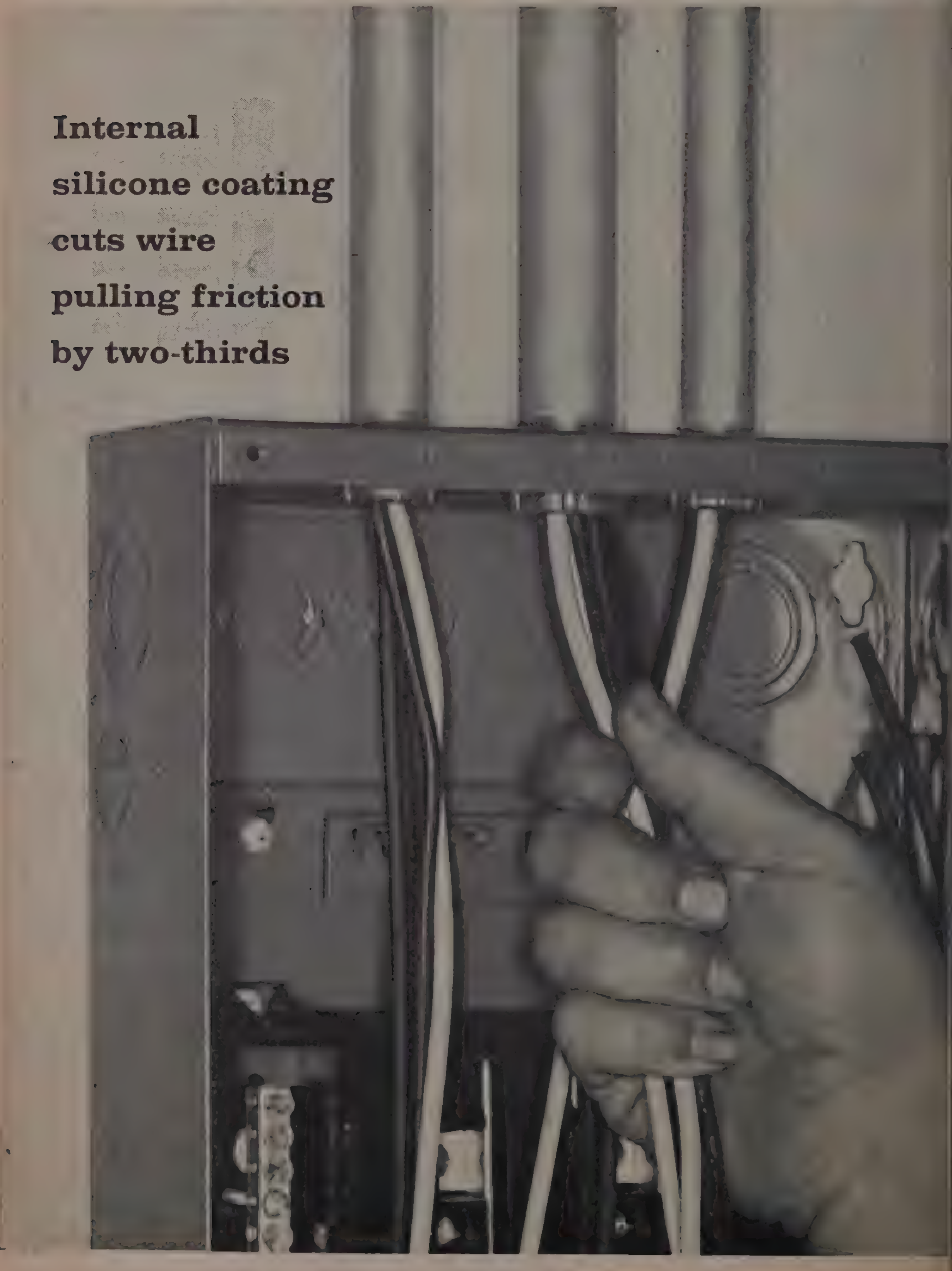

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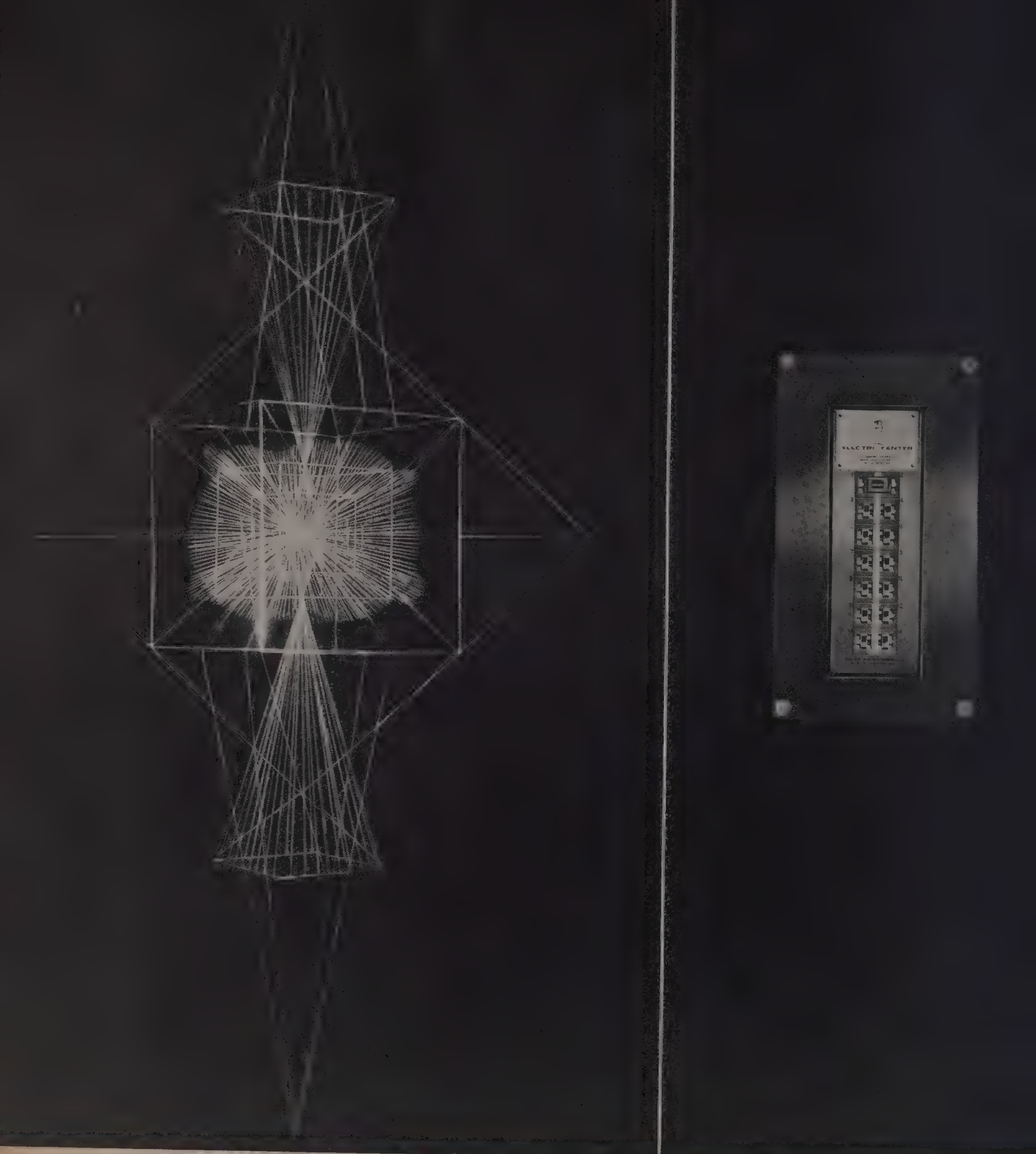

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All-Industry Meeting In Buffalo Marks 45 Strikeless Years

At a dinner meeting unprecedented in recent times, about 350 electrical industry people of Buffalo, N. Y. and the Niagara Frontier, on May 21 celebrated 45 years of strikeless labor-management relations and honored two electrical industry leaders for long and dedicated service to the industry and the community.

Raymond W. Mitchell, honorary director of the New York State Association of Electrical Contractors and Dealers, received a gift from Robert J. Biggane, managing director, on behalf of the State association, and a Veteran Membership in the National Electrical Contractors Association from Raymond J. Knoblock, vice-president District 1 of NECA.

Karr Parker, Sr., president, Buffalo Electric Co. and chairman of the Labor Committee of Associated Electrical Contractors of Buffalo, received a plaque from Alfred H. Kirchhofer, editor of the *Buffalo Evening News* "in recognition of your civic contributions and the work you have done to advance labor peace in Buffalo and on the Niagara Frontier." Mr. Kirchhofer cited Mr. Parker's many outstanding contributions to the community in educational, church, civic and business affairs.

Discussing his industry's remarkable record of labor-management harmony, Mr. Parker emphasized the importance of "sincere desire" on the part of both parties to reach an "equitable" settlement. He also cited his committee's practice of negotiating with only a few people and employing complete secrecy during bargaining.

Charles H. Pillard, business manager, Local 41, IBEW, also credited the outstanding record to "a sincere desire by both parties to negotiate . . . to the good of the parties and the industry as a whole."

Gwilym A. Price, chairman, Westinghouse Electric Corp. and toastmaster for the dinner, predicted that in the next ten years we shall build and install enough new power facilities in the United States to power another United States and in the next 20 years as much as exists in the whole world today. Of the Niagara Frontier he said that nowhere else has so much power capacity been built so fast and nowhere else is there such a mighty concentration of electric power facilities.

Lauman Martin, vice president, Niagara Mohawk Power Corp., deplored the continued use of some obsolete 25-cycle power in the area and asked the cooperation of others in the industry to persuade users to change to modern 60-cycle facilities. He also outlined a program of increased advertising and promotion to sell more electricity in Western New York.

Paul E. Bowers was chairman of the all-industry committee in charge of the meeting. W. L. Collins was co-chairman. L. W. Anderson, P. A. Frey, L. J. Stroh, J. P. Wells, C. O. Dean, D. F. Germony, H. B. Vidal, R. Wilson and H. C. Zang also served on the committee.

Electric Heating Conference Held in Arizona

A two-day Electric Comfort Heating and Lighting Conference and Exhibit was held on May 10 and 11 at the Arizona State University in Tempe, Ariz. Sponsored by the Electric Comfort Heating and Lighting Committee of the Arizona Electric Utilization Council, the program was planned and moderated by chairman Ray N. Phillips, power utilization manager, Sulphur Springs Valley Electric Cooperative, Inc., Sierra Vista, Ariz.

The meeting opened with a discussion of the electrical contractors' opportunities and responsibilities in electric heat by W. J. Novak, associate editor, *Electrical Construction and Maintenance*. He described the extent to which the contractor may participate in a specific heating job, ranging from the role of subcontractor to a specialty heating installer all the way to assuming complete responsibility for the design, installation, and thermal insulation. He also emphasized the importance of establishing maximum economical levels of insulation in any given area, indicating that such levels may be a good deal higher than generally supposed.

This opinion was supported by Fred E. McVey, Chief of the Electric Farming Branch of REA's Electrical Distribution Division in Washington, D. C., who presented a paper on thermal insulation for electric comfort heating. He described his own investigations as showing a national average heat factor for electrically heated houses of 0.33 kwhr/cu ft/1000 degree-days (or 2.64 kwhr/sq ft of floor area/MDD based on an 8-ft ceiling height). Following the All-Weather Comfort Standard seems to produce a heat factor closer to 0.24 kwhr/

NEWLY-ELECTED OFFICERS of EASA's Great Lakes Chapter at their installation at a dinner meeting at Palmer Electric Co., Detroit, Mich.: back row from left—Ralph Templin, Seneca Electric Co.; William Cotter, Cotter Electric Co., and Jerry Cohen, J-C Electric Co., directors; and John R. Watterson, United Electric Motor Co., treasurer. Front row—Joe Bilicki, Re-Nu Electric Co., vice-president; Chris Palmer, Palmer Electric Co., president; and Charles Smith, Gordon Electric Motor Co., secretary.

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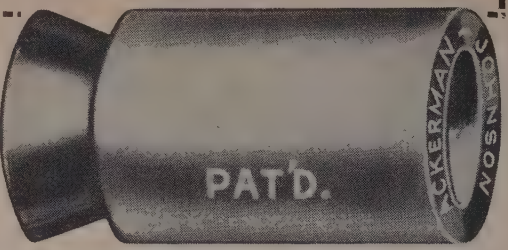

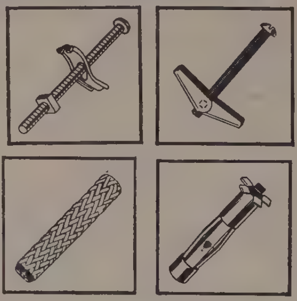

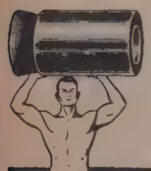

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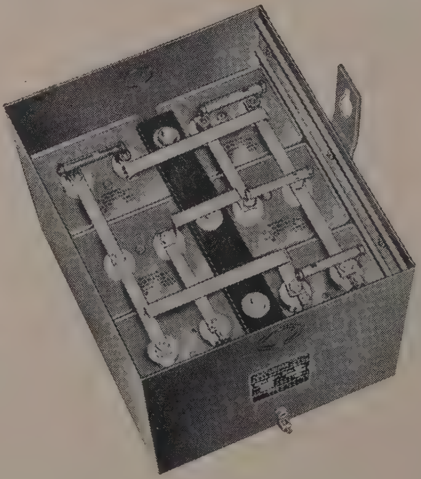


ALABAMA SHOP MEN gather at a meeting of EASA's Mid-South Chapter in Birmingham—John McDaniels, Cleveland Electric Co.; Melvin Hudson, Southern Carbon Brush Co.; Herschel Metts, Vulcan Electric Distributors, Birmingham; and George Mouchette, Eddie's Electric Motor Service, Tuscaloosa.

cu ft (1.92 kwhr/sq ft), and Mr. McVey claimed that a figure of 0.15 kwhr/cu ft (1.2 kwhr/sq ft) is a very practical target for comfort and economy for new homes.

Joseph Felber, marketing analyst, National Electrical Contractors Assn., described NECA's new CGB comfort system of certifying and guaranteeing electric heating equipment and operating costs for its member contractors.

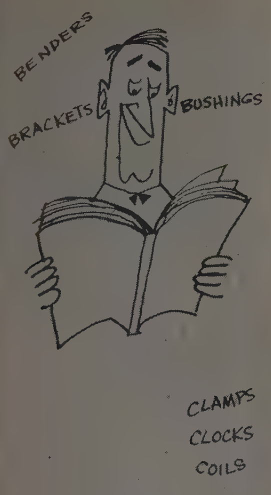
Operation and applications of the heat pump and electric furnace were discussed by Hiram Andrade, General Electric Co. Jim Sorensen of Lowry & Sorensen, Phoenix consultants, told of local applications of electric heat. Steps necessary to effectively advertise electric heat were outlined by Lowell Endahl, manager, Power Use Section, National Rural Electric Cooperative Assn., Washington, D. C. Using color slides, Paul D. Johnson, Minneapolis-Honeywell Regulator Co., covered available electric heating thermostats and modulating controls.

The lighting portion of the meeting was handled by Max A. Pooler and Jerre Blair, General Electric Co., who emphasized the sales potential in residential lighting and outdoor lighting.

Chicago Electricians Get $5 Rate, 7-Hour Day

A pay raise and shorter work day were granted Chicago area electricians employed in the construction industry. A two-year labor agreement, negotiated between the Electrical Contractors Association of

ATTENTION—MANUFACTURERS OF ELECTRICAL PRODUCTS:



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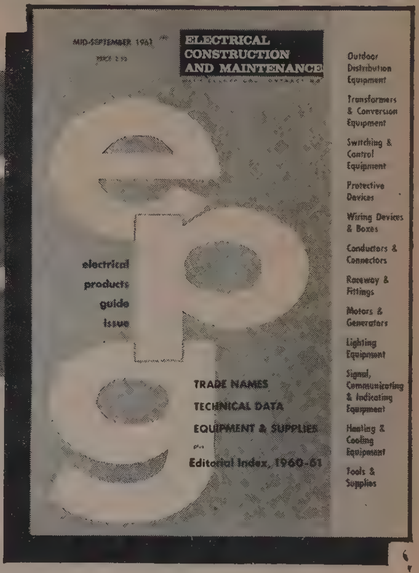

MID-SEPTEMBER 1961

ELECTRICAL CONSTRUCTION AND MAINTENANCE

epg

electrical products guide issue

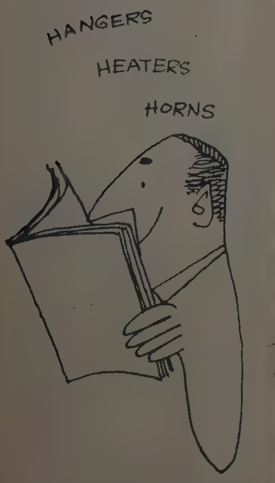
TRADE NAMES
TECHNICAL DATA
EQUIPMENT & SUPPLIES
Editorial Index, 1960-61

Outdoor Distribution Equipment
Transformers & Conversion Equipment
Switching & Control Equipment
Protective Devices
Wiring Devices & Boxes
Conductors & Connectors
Raceway & Fittings
Motors & Generators
Lighting Equipment
Signal, Communicating & Indicating Equipment
Heating & Cooling Equipment
Tools & Supplies

Whatever they're looking for in the way of electrical equipment, apparatus and supplies, electrical men refer to the ELECTRICAL PRODUCTS GUIDE over and over during the year. Your one insertion in the EPG gives you 12 solid months of advertising mileage!

The ELECTRICAL PRODUCTS GUIDE is published annually in mid-September by Electrical Construction and Maintenance. In its nine years of existence the EPG has won recognition and acceptance as the industry's "who-makes-it" book. In a study conducted at the end of 1961, 97% of respondents reported that they found the EPG useful...93% still retained their copies of the 1960 Guide...on an average, users referred to the EPG once a week.

Your ELECTRICAL PRODUCTS GUIDE advertising presents your selling message at decisive moments when electrical men are digging for facts to help them select and buy. The EPG serves too as an effective means of stimulating traffic in your product catalogs. In your EPG advertising be sure to list product bulletins and catalogs which supply detailed specifications and application data on your complete product line!



CLOSING DATE FOR THE MID-SEPTEMBER

ELECTRICAL PRODUCTS GUIDE:

July 18th

EPG REACHES ALL 3 BUYING INFLUENCES:

More than 46,600 electrical men will receive the 1962-63 ELECTRICAL PRODUCTS GUIDE. They are paid subscribers to ELECTRICAL CONSTRUCTION AND MAINTENANCE: (1) electrical contractors...(2) plant electrical engineers...(3) consulting electrical engineers. All have been checked by rigid paid-circulation standards. The EPG goes only to men who have direct influence on the purchase of your electrical products!

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- 46,000# tensile strength chain compared to 28,000# of competitive units.

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(when other ballasts are only guaranteed for one?)

One good reason is Mylar insulation in the transformer which helps give the Wide-Lite ballast far better resistance to heat due to overvoltage, excessive harmonics and high surrounding temperatures. Another reason is that both indoor and outdoor Wide-Lite ballasts are sealed in a special potting compound. Want more reasons? Just write!

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FLOODLIGHTS • BALLASTS • INDOOR LUMINAIRES

City of Chicago and Local 134, International Brotherhood of Electrical Workers, establishes a $5 per hour wage scale and a 35-hour work week. The present two-year contract expires July 1.

The new pact calls for a boost from $4.50 to $4.75 per hour for journeymen beginning July 1, 1962. On November 5, the hourly rate goes up to $5.00 and the 7-hour day becomes effective.

This reportedly is the first time a building trades group in the middle west has negotiated an agreement for less than the conventional 40-hour work week. Local IBEW officials cite unemployment conditions during the past winter months as a basis for the shorter work week demand.

171 Attend N. J. IAEI Seminar

On March 31, the Mountainside Inn, Mountainside, N. J., was the scene of an all-day seminar on Modern Electric Controls. Sponsored by the New Jersey Chapter of the International Association of Electrical Inspectors, the Seminar included talks on motor controls, magnetic contactor applications, automatic transfer switching and emergency power sources for use in buildings. In addition, manufacturers of control equipment had exhibits of their products and demonstrations.

The day's program was based on "Modern Electric Controls," the reprint of the editorial feature section of the July 1961 issue of *Electrical Construction and Maintenance*. A total of 171 persons attended the seminar, including

ORLAND B. FINCH, Southern Carbon Brush Co., Birmingham, Ala., at (left), meets Arthur Grisanti, Trobaugh Electric Co., Memphis, Tenn., and A. S. Brown, Electrical Repair Service, Birmingham, Ala., at a recent meeting of EASA's Mid-South Chapter.

POINTING to a feature in a motor stator is George Mabry, Brook Motor Corp., Birmingham, Ala. In center is W. J. Howard, Standard Electric Co., Montgomery, Ala.; and Gerald Rose, Insulation & Wires, Inc., Memphis, Tenn. The occasion was a meeting of EASA's Mid-South Chapter in Birmingham, Ala.

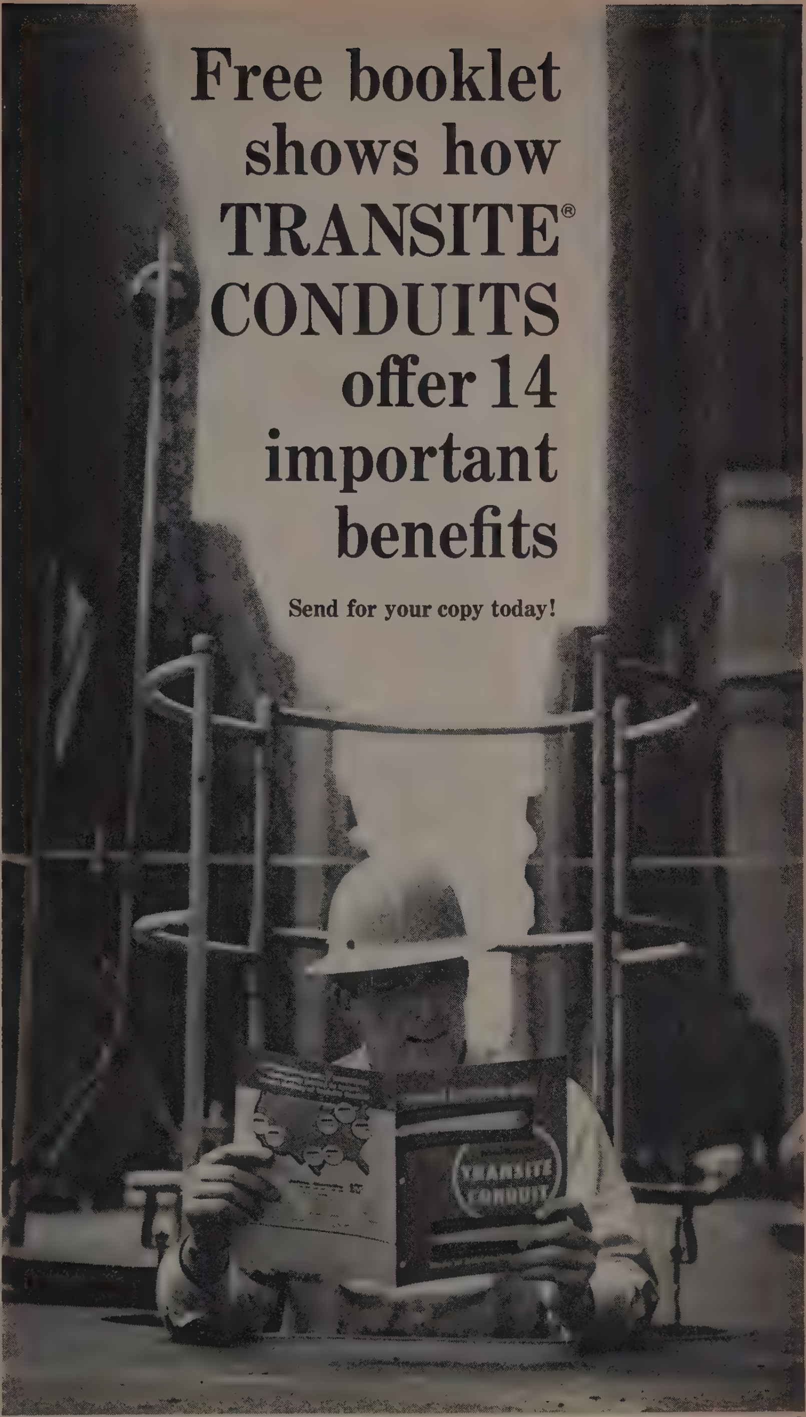
electrical contractors, consulting engineers, plant electrical men and electrical inspectors.

The morning session was conducted by J. F. McPartland, associate editor, *Electrical Construction and Maintenance,* who discussed motor controls, NE Code rules on control, and design and layout of control circuits. The last 45 minutes of the morning session were devoted to answering questions from the floor. A panel of manufacturers—Vic Vaughan Jr., Square D Co.; Tom Cavanaugh, Federal Pacific Electric; and Hank Meyer, Furnas Electric—took part in the question and answer period.

At the afternoon session, Henry Wenson, chief electrical engineer, Port of N. Y. Authority, delivered an interesting talk on the growing importance of static switching devices and circuits. He discussed the advantage of such devices in place of conventional relay controls which introduce serious problems of space, reliability and maintenance in many complex systems.

John Nicholas, former chief engineer, John Reiner Co., spoke on the selection and application of emergency generator plants. He covered diesel, gas and gasoline units for providing emergency electric power. Noting the greatly increased emphasis on emergency power sources for buildings of public occupancy, he presented data which the contractors and engineers will use in working with emergency plants.

A panel discussion followed the talk. And it was brought out that the State of Pennsylvania has enacted a law making emergency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. . . write for this Bulletin
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WORLD FAIR Coliseum and U. S. Science Pavilion at Seattle's "Century 21" exposition was electrified by Van S. McKenny Co., electrical engineering and contracting. Electrical work for both projects, exceeding $1-million, was supervised by Ralph C. Moreau, pictured above.

power mandatory in buildings of public occupancy. New York City has also made such a provision, and New Jersey has a similar law pending before its legislature. The two related topics of emergency power and application of automatic transfer switches formed the basis of lively question and answer discussions.

EASA News

Nieves Electric Service, Ponce, Puerto Rico, has been accepted for membership in the Electrical Apparatus Service Association, Inc., according to an announcement by George Larsen, Los Angeles, international president.

The firm, however, is not the first company located in the Commonwealth to join the association. Delta Electric Motor Co., Hato Rey, has been an EASA member for many years. Stateside Service, San Juan, has also been accepted for membership. There are also EASA shops in Jamaica, Mexico, and, of course, Canada, as well as in all 50 of the United States.

• • • •

A growing number of newsletters are being published by EASA chapters, the most recent being bulletins issued by Wisconsin and Western Michigan groups. In all, eleven of the association's 39 local, regional and state organizations publish a periodic newsletter, usually monthly.

• • • •

With the completion of Electronic Motor Control Course in San Francisco, May 21-23, more than 450 EASA shop men have completed one or both of the basic and advanced courses sponsored by EASA. Most of the courses, held in major cities throughout the United States, were sell-outs.

• • • •

The dramatic story of how EASA firms in the Philadelphia area came to the rescue of the storm-stricken Jersey Shore last March, has been told by James Previty Sr., president of Quacker City Chapter. Working 'round the clock, more than 75 companies in Pennsylvania, New Jersey, Maryland and Delaware, worked for many weeks repairing and rewinding motors that were damaged by the rains and high tides that had left hundreds homeless and caused millions of dollars damage to industry.

Chief among the immediate repair jobs to be done was the servicing of furnace motors for oil burners, refrigerators and other essential equipment. Air conditioning motors were next.

To assure the citizens of the Jersey area of prompt and reliable service, EASA shops bought a half-page ad in the *Atlantic City Press* of March 13. "To the many families and homeowners who are without heat or other facilities due to appliance motor failure who find it difficult to obtain repairing and rewinding service or replacement of motors—To circumvent the possible intrusion of unfair practices and prices at a time of great need, distress and suffering, the below listed members of Quaker City Chapter of EASA pledge their facilities in the spirit of humanitarian principles and cooperation to the residents of the entire disaster area," the ad began.

EASA president George Larsen, Los Angeles, described the act as "one of the finest examples of independent small business cooperation

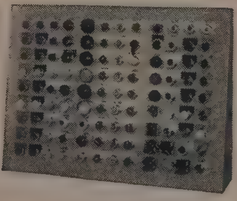
EASA DIRECTORS Paul Bush, Lubbock, Texas (left), and Walter Brush, Birmingham, Ala. (right), meet with EASA president George Larsen (second from left) and Mid-South Chapter president Norvell Ogden, Jackson, Miss. at a recent EASA meeting in Birmingham, Ala.

More dependable designs from the Rees quality line of oil, water and dust tight controls!
START
STOP
TOP
STOP

All rugged Rees controls are extra heavy-duty and mount in condulets!

These trouble-free, extra heavy-duty controls are just a few models from the wide Rees line . . . all ready for easy condulet mounting! And with Rees you get fully sealed protection—*below heavy-duty prices.* You'll find the right pushbutton for *any* application . . . with "REES-RELIABLE" performance! Rees also has a complete range of oil-tight, ultra-reliable, chrome-plated controls for single hole mounting.

For the latest in controls write for your free complete line catalog from Rees.



CONTROL UNITS

LIMIT SWITCHES

"KICKLESS" WELDING CABLES

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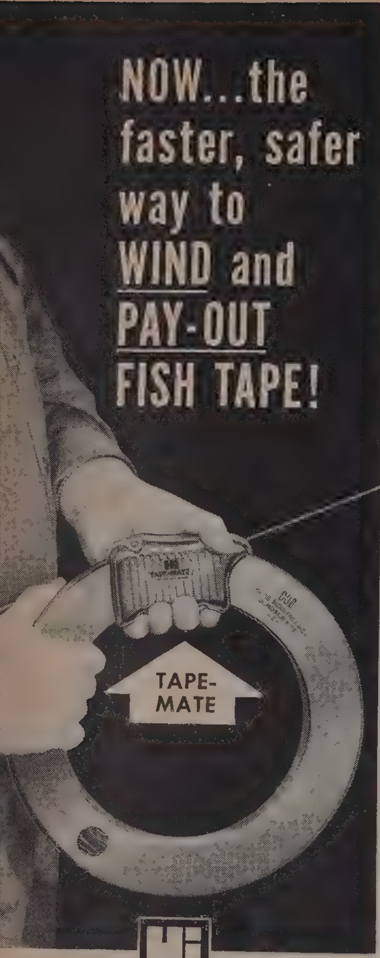

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ONVERT YOUR PRESENT REELS...OR ET COMPLETELY ASSEMBLED UNITS: EEL, FISH TAPE AND TAPE-MATE

SPECIAL CHROME PLATED UNIT
For the man who wants the best. Tape-Mate assembled on chromium plated reel. Special steel tape included. Long lasting.

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AT A RECENT MEETING of EASA's Mid-South Chapter, in Birmingham, Ala., were Ray C. Caudle, Vulcan Electric Distributors, Inc., Birmingham, Ala.; Tom Russell, Russell Electric Co., Mobile, Ala.; and Ross A. Burkett, Burkett's Electric Motor Service, Jackson, Miss.

I have seen in many years."

• • • •

EASA president George Larsen has wound up his term of office with visits to a large number of chapters throughout the country.

His itinerary included Chicago; Mid-America Conference in Kansas City, Mo.; Birmingham, Ala.; New England Foremen's Meeting in Worcester, Mass.; New York; Philadelphia; and Wisconsin Chapter, meeting in Madison.

• • • •

Melvin J. DeYoung, Whittaker Electric Co., Muskegon, Mich., was honored recently by the association as "EASAN of the Month." Motor shop superintendent for his firm, Mr. DeYoung, 37, has been active in the affairs of Western Michigan Chapter.

• • • •

In his travels across the country in behalf of the association, EASA president George Larsen said recently that, in his opinion, the shops making best profit were the ones concentrating on the management side of their businesses. Usually these firms send a representative to the international EASA conventions, he noted.

NAED Meets In Pittsburgh

The 54th annual convention of the National Association of Electrical Distributors convened in Pittsburgh, Pa., from May 12-16 with more than 1900 members and guests attending. The theme of this year's conference was "communications," with customers, suppliers, employees and the public.

As is customary at NAED con-

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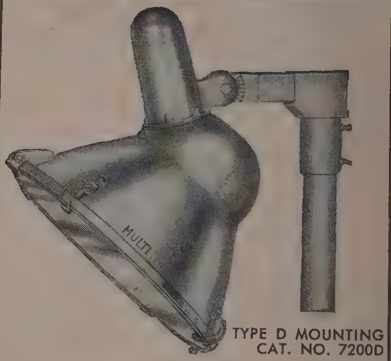

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For 500 Watt or 1500 Watt
INCANDESCENT LAMPS

Designed to best utilize incandescent lamps for maximum light output, this Multi all weather enclosed, angle type floodlight is just one of the many in the Multi quality line.

Features:

Reflector is aluminum with alzak finish

Socket housing is cast aluminum wired

Lens is heat & impact resistant mounted in hinged at top weather-tight cover.

All fasteners are stainless steel

There is a variety of mounting fittings to meet all conditions

This floodlight also available for 400-1000 Watt mercury vapor lamps.

Write for Catalog of Complete Multi Line of Quality Lighting Equipment

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ventions, executives of manufacturers selling through electrical wholesalers occupied nearly 250 conference booths at the Pittsburgh coliseum to be available to the wholesalers for consultation.

Ralph W. Rohrbach, president, Pacific Wholesale Electric Co., San Diego, Cal., was elected president of NAED, succeeding B. H. Boatner, president, Westinghouse Electric Supply Co. Other officers elected were: John M. Newton, Jr., president, Oakes Electric Supply Co., Holyoke, Mass., re-elected vice president—Eastern region; John W. Shealy, president, Shealy Electrical Wholesalers, Greenville, S. C., re-elected vice president—Southern region; C. E. Butler, Jr., president, Butler Electric Co. Inc., St. Louis, Mo., re-elected vice president—Central region; and James B. Hartwig, vice president and general manager, North Coast Electric Co., Seattle, Wash., elected vice president—Western region.

NFPA Annual Meeting

The National Fire Protection Association held their 66th annual meeting during the week of May 21-25. During this five-day meeting electrical standards and discussions of electrical problems stimulated the interest of the entire electrical industry. Most important of the several electrical standards adopted was the 1962 NEC, which will be published in September of this year. Other NFPA standards concerning electrical equipment included Machine Tools (No. 79), Electronic Computers (No. 75), Flammable Anesthetics (No. 56).

On May 21, Paul W. Stoneburner of the Aluminum Association ad-

SESSION PANEL answering questions on electrical inspection field problems at recent Western Section IAEI meeting in Oklahoma City included: (L to R) electrical inspectors J. E. Fisher, Elkhart, Ind.; Gordon Maltby, Evanston, Ill.; and engineer Roy J. Thompson, Oklahoma City. H. B. Love, Detroit, was panel moderator.

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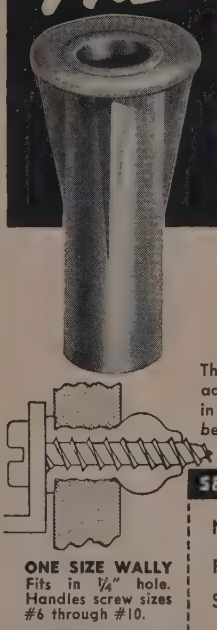

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EASY TO USE . . . LOW IN COST

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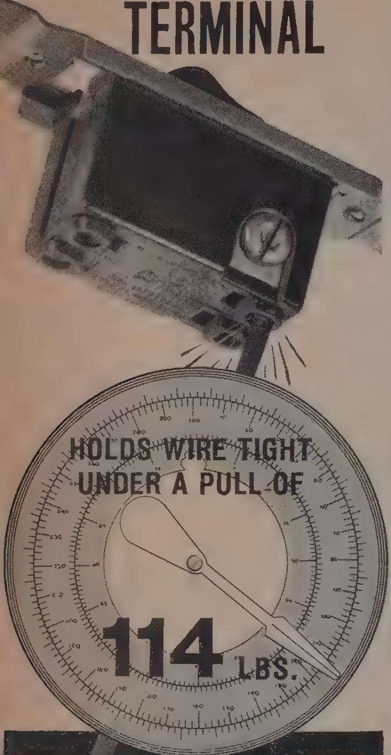

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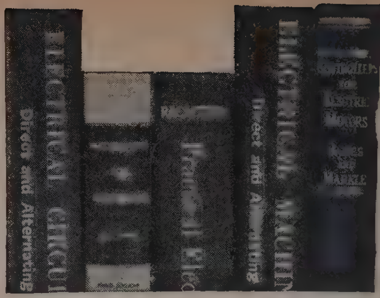
"PERFECTION IS NOT AN ACCIDENT"

dressed the Fire Marshals Association of North America with the timely subject of "Grounding of Aluminum Siding." Stoneburner described the extensive tests that have been made to determine the effects of lightning in connection with aluminum siding and the possibility of shock hazard in the event defective electrical equipment should energize metal siding.

The meetings concerning the 1962 NEC were held for two days. On May 22, H. B. Whitaker, Chairman of the NEC Committee, chairmanned the informal meeting of the Electrical Section. This meeting gave the electrical industry the opportunity to discuss the proposed code revisions listed in the 1962 NFPA Advanced Reports (pages 600 to 752). Discussions were relatively moderate with the exception of an objection by NEMA concerning code recognition of a 3-pole grounding-type receptacle cap with a movable, self-restoring grounding contacting member. Code Panel No. 5 had endorsed the principle of such a receptacle cap for cords supplying hand-held tools and hand-held appliances as an alternate of a receptacle cap which has a fixed grounding contacting member. The purpose of the movable-type cap is to make it possible to connect a grounding-type cap into an existing non-grounding type receptacle without the use of an adapter. Attempts by NEMA to delete code recognition to this new receptacle cap principle were rejected.

On the following day, Loren S. Bush, retiring president of the NFPA, chairmanned the formal session of the Electrical Section where the 1962 NEC was presented for final approval. At this meeting NEMA proposed an amendment to revise the wording of the new code rules recognizing a receptacle cap with a movable, self-restoring grounding contact member. This amendment, which proposed additional design specifications, was defeated. A few other attempts to revise some proposed code rules were also rejected. However, an attempt by Chris Klawa, chief inspector for the State of Oregon, to provide an exception to Paragraph 210-21 (b) did receive some favorable comments even though his proposal was rejected. This subject concerned the permitted use of non-grounding type receptacles on existing installations where receptacles are added to existing circuits and a grounding means is not readily available. The 1962 NEC was unanimously approved and should be available this September.



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- **MATHEMATICS** . . . the mathematics the electrician uses . . . from simplest wiring formulas to solution of complicated circuit problems
- **WIRING** . . . how to wire for light and power . . . farm, residential, and nonresidential installations . . . instructions for planning and doing
- **ELECTRICAL MACHINES** . . . generators, motors, transformers, converters, controllers, etc. . . . facts you need to select, install, and operate them
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DATES AHEAD

National Society of Professional Engineers—Annual meeting, French Lick Sheraton Hotel, French Lick, Ind., June 13-16.

International Association of Electrical Inspectors — Chapter Meetings — **Virginia**, Hotel John Marshall, Richmond, Va., June 18-19; **Southern Section**, Tutwiler Hotel, Birmingham, Ala., October 15-17.

Los Angeles Home Show — Memorial Sports Arena, Los Angeles, Calif., June 21-July 1.

American Society of Heating, Refrigeration & Air Conditioning Engineers Inc.—69th annual meeting, Deauville Hotel, Miami Beach, Fla., June 25-27.

N. Y. State Assn. of Electrical Contractors & Dealers—Annual convention, Whiteface Inn, Lake Placid, N. Y., July 2-7.

Western Electronic Show & Convention — Memorial Sports Arena, Los Angeles, Calif., August 21-24.

American Home Lighting Fixture Month—National promotion, September 1-30.

Illuminating Engineering Society—National technical conference, Statler-Hilton Hotel, Dallas, Texas, September 9-14.

Canadian Electrical Mfrs. Assn.—Annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., October 3-5.

International Assn. of Electrical Leagues — 27th annual conference, Sheraton-Chicago, Chicago, Ill., October 3-5.

National Electrical Contractors Assn. — Minneapolis Auditorium, Minneapolis, Minn., October 7-13.

National Electronics Conference—McCormick Place, Chicago, Ill., October 8-10.

Rocky Mountain Electrical League—Fall convention, The Broadmoor, Colorado Springs, Colorado, October 14-18.

Electrical Manufacturers Trade Show—Indiana State Fair Grounds, Indianapolis, Ind., October 23-25.

National Electrical Manufacturers Assn. — Annual meeting, Shoreham Hotel, Washington, D. C., week of November 12.

Building Research Institute—Fall conference, Mayflower Hotel, Washington, D. C., November 27-29.

Electrical Engineering Exposition — Sponsored by AIEE, Coliseum, New York, N. Y., January 28-31, 1963.

16th International Heating & Air Conditioning Exposition—Coliseum, New York, N. Y., February 11-14.

4th Southeastern Plant Engineering and Maintenance Exposition — Merchandise Mart, Charlotte, N. C., March 5-7.

Among the Manufacturers

Headquarters Announcements

Harvey Hubbell, Inc., Bridgeport, Conn., has acquired **The Kellems Co., Inc.,** Stonington. Conn.

DuKane Corp., St. Charles, Ill., has announced that the name of their Commercial Sound Div. will be changed to the Communications Systems Div.

General Electric Co., Cleveland, Ohio—Joseph M. Lime, manager of marketing; John W. Wright, manager of manufacturing—both with Large Lamp Dept., Nela Park.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.—Stanley J. Nelson, vice president, Residential Div.

Burndy Corp., Norwalk, Conn.—Julian Rogoff, president; Marvin Lee, vice-chairman of the board of directors; Bern Dibner, continues as Board chairman.

Oak Manufacturing Co., Crystal Lake, Ill. — Robert A. O'Reilly, chairman of the board; Stewart Pfannstiehl, executive vice president; R. D. Wilbur, treasurer.

Philip Carey Mfg. Co., Cincinnati, Ohio — Frederick A. Dathe, sales manager for industrial insulation products.

International Resistance Co., Philadelphia, Pa. — J. Burton Henry, vice president; Charles G. Smith, director of field sales.

Insulation and Wires Inc., Fort Wayne, Ind.—Fred Simon, sales manager.

Fostoria Corp., Fostoria, Ohio—R. W. Jeffery, technical director, research and development.

Wiremold Co., Hartford, Conn. —William E. Parks, sales manager, Electrical Div.; William D. Ball, director of sales and will continue as secretary.

Western Semiconductors, Inc., Santa Ana, Calif. — D. William Jackson, vice president—finance and treasurer.

Basic Products Corp., Milwaukee, Wis.—Jerome M. Frank, vice president of sales, Hevi-Duty Electric Div.

Penn Controls, Inc., Goshen, Ind. — Grover M. Russell, vice president—director of engineering, Goshen Div.

Standard Transformer Co., Warren, Ohio—Ted E. Gaty, vice president of sales.

Youngstown Sheet and Tube Co., Youngstown, Ohio — Richard

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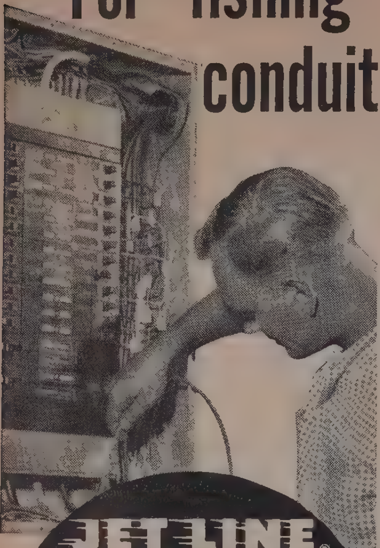

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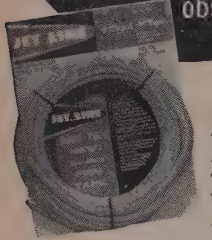

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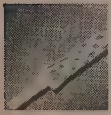

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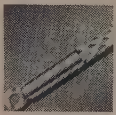

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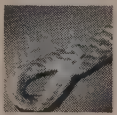

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J. Stamberger, general manager of sales; Donald C. Umbel, manager of trade relations.

Slater Electric Inc., Glen Cove, N. Y.—Henry Blum, vice president in charge of wiring device manufacturing.

Worthington Corp., Harrison, N. J.—Robert E. Marshall, vice president of general counsel and secretary.

Daystrom, Inc., Worcester, Pa.—Richard E. Bennett, general manager, Transicoil Div.

Sylvania Electric Products Inc., New York, N. Y.—Gordon L. Fullerton, vice president and general manager, Receiving Tube Operations, Electronic Tube Div., Emporium, Pa.; Eugene E. Broker, general manager, Parts Div., Warren, Pa.

Jefferson Electric Co., Bellwood, Ill.—W. Scott Minter, vice president of finance; Henry F. Tobler, vice president of industrial relations; Bertrand J. Farrell, vice president of marketing; James L. Mammoser, secretary; William C. Anderson, director of engineering.

United Shoe Machinery Corp., Shelton, Conn.—Frederick W. Burgess, supervisor—customer relations, Fastener Div.

Young Spring & Wire Corp., Bowling Green, Ohio—Joseph H. Barnett, vice president, Equipment Div.

Century Lighting, Inc., New York, N. Y.—Rollo G. Williams, national sales manager.

Kuhlman Electric Co., Birmingham, Mich.—James E. Jones, manager of advertising and sales promotion.

John C. Virden Co., Cleveland, Ohio—Vernon L. Wrye, vice president of sales.

Pyle-National Co., Chicago, Ill.—Charles P. Currie, vice president of sales.

Westinghouse Electric Corp., Pittsburgh, Pa.—Burr Tupper, manager of systems engineering and development for construction group; Douglas D. Danforth, vice president.

Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y.—Frank B. Dickey, vice president, Magnet Wire Div.; Robert E. McIlvane, vice president, Communications Products Div.; R. Bruce Van Wagner, vice president, Market Planning and Development.

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Lear, Inc.: William H. Krapf, district representative in eastern region with offices in Stamford, Conn.; Electro-Mechanical Div.

MIDDLE ATLANTIC

Okonite Co.: Walter W. Hammond, district manager of Philadelphia sales office.

Federal Pacific Electric Co.: J. R. Mahaffey, regional sales manager for central region and part of New York state with headquarters in Pittsburgh.

Ortho Industries Inc.: Leonard D. Allen, Inc., Syracuse, sales representative covering New York state, exclusive of the metropolitan area.

Thompson Electric Co.: Peter A. Price, representative for new office in New York City.

SOUTH ATLANTIC

Dayco Corp.: J. O. Quamme, manager of Atlanta region, Industrial Sales Dept., Rubber Products Div.

Harvey Aluminum: Eastern Sales Co., Baltimore, representative for metropolitan Washington, D. C. and Maryland; Ernest T. Loyd, Inc., Atlanta, sales representative for Florida, Georgia, North and South Carolina, Tennessee and Virginia.

Champion Lamp Works: Cary Chapman & Co., Atlanta, sales representative for Georgia, Alabama, Tennessee, Louisiana, North and South Carolina, Florida and southwestern Virginia.

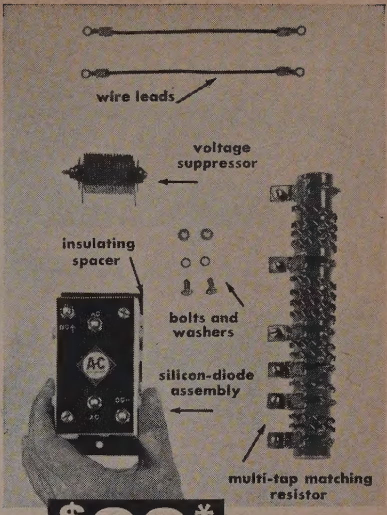
International Resistance Co.: G. Jack Wilson, marketing manager of St. Petersburg, Fla., division.

Atlantic Metal Hose Co., Inc.: John F. Templeton Co., Atlanta, Ga., representative.

Consolidated Pipe Co. of America: Campbell & Woods Agency, Cary, N. C., sales representative for Maryland, Virginia, Washington, D. C. and North and South Carolina.

EAST CENTRAL

Motorola Communications and Electronics, Inc.: Eric J. Goleas, manager of two-way radio sales for the midwest; John R. Fedell, regional sales manager for Chicago, northern Illinois and southern Wisconsin—both men headquartered in Chicago.



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Atlantic Metal Hose Co., Inc.: Jim House & Associates, Birmingham, Ala., representative; William Berrington & Son, Inc., Cleveland, Ohio, representative.

General Electric Co.: James F. Murray, East Central district sales representative with offices in Cleveland; Silicone Products Dept.

Thomas Industries Inc.: Albert O. Grotenhuis, Ohio divisional sales manager based in Louisville.

Allen-Stevens Conduit Fittings Corp.: Gregory & Flynn, Cleveland, sales representative for Ohio and northern Kentucky; Steinberg-Groh & Associates, Oak Park, sales representative for Michigan.

Bishop Mfg. Corp.: Gene Goodman & Associates, Memphis, sales representative in Tennessee, Arkansas and northern-half of Mississippi.

Fullman Mfg. Co.: Goldschmidt Electrical Sales Co., Cincinnati, representative in Kentucky, southern Ohio and southern Indiana.

Lear, Inc.: George L. Gouth, branch manager of new sales office in Skokie, Ill.; Electro-Mechanical Div.

Consolidated Pipe Co. of America: Arthur W. Rogers, Arlee Electric Sales Inc., Detroit, representative for Michigan; Bryan Carson, Memphis, representative for southern Arkansas, central Mississippi and western Tennessee.

Ilg Electric Ventilating Co.: James Roberts, Jr., branch manager of new Memphis office.

Westinghouse Electric Corp.: William W. Weitzel, lighting sales engineer in Detroit area.

Rockbestos Wire & Cable Co.: George E. Merritt, Detroit district sales manager.

Carpenter Steel Co.: F. Richard Langenbeck, branch manager in Milwaukee.

WEST CENTRAL

Dayco Corp.: J. T. Dempsey, manager of southwestern region with headquarters in Dallas; William H. Hill, district manager with headquarters in St. Paul; Industrial Sales Dept., Rubber Products Div.

Bishop Mfg. Corp.: R. C. Hauk, Metairie, La., sales representative for Louisiana and southern half of Mississippi.

Youngstown Sheet and Tube Co.: Walter R. Craig, Dallas district sales manager.

Cutler-Hammer Inc.: C. R. Deckard, branch manager of new Dallas, Texas, branch assembly plant; Mullenbach Div.

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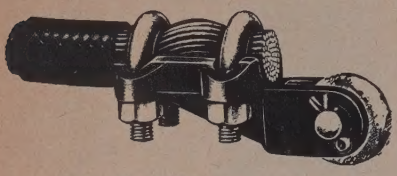

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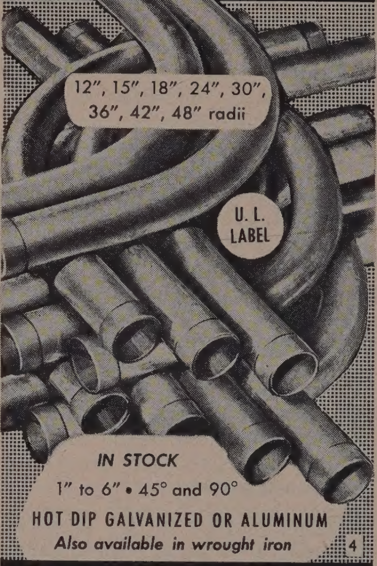

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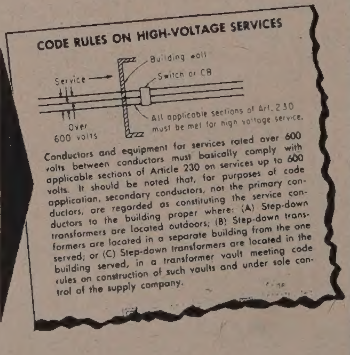
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WEST

International Resistance Co.: Michael A. Gallucci, western district manager with headquarters in Los Angeles.

Brown Co.: Theodore M. Marshall, Jr., west coast sales supervisor with headquarters in San Francisco, Fiber Pipe and Conduit Div.

Fostoria Corp.: M. J. Hooey, San Francisco, area manager for northern California, western Nevada and Hawaii.

Owatonna Tool Co.: Harry E. Roderick, district manager for San Francisco and north central California territories, plus Nevada excluding Clark County; Tools and Equipment Div.

Mueller Electric Co.: George E. Lewis Co., Alhambra, sales representative for California, Arizona and Nevada; Richard Legg Co., Portland, sales representative for Oregon, Washington and Alaska.

Hubbard & Co.: William Featherstone, division sales manager, West Coast Div., with offices at Emeryville, Calif.

G&W Electric Specialty Co.: Shaffer & Nelson, Inc., Portland, sales representative in Oregon and parts of Washington.

Harvey Aluminum: Southwest Agencies, Phoenix, sales representative for Arizona and Clark County, Nevada.

General Electric Co.: Ronald N. Brake, Western District sales representative with offices in Downey, Calif.; Silicone Products Dept.

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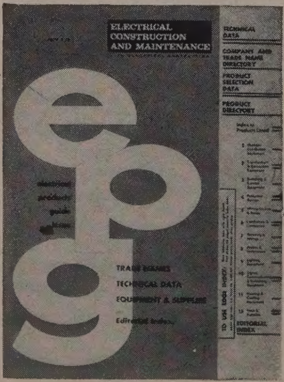

• These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE ISSUE

For more complete information, and application data on their lines, refer to the index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.